mental health digest

National Clearinghouse for Mental Health Information, Vol. 4, No. 5, May 1972

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cover story

Memory

Memory has been a classic topic in psychology for many centuries. Besides all the traditional techniques there have emerged in recent years new methods, many of them derived from biochemistry, neurophysiology, and computer technology, that are contributing to an understanding of memory. This issue of the *Digest* contains several condensations of articles on recent research and theorizing on memory.

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, May 20, 1968.

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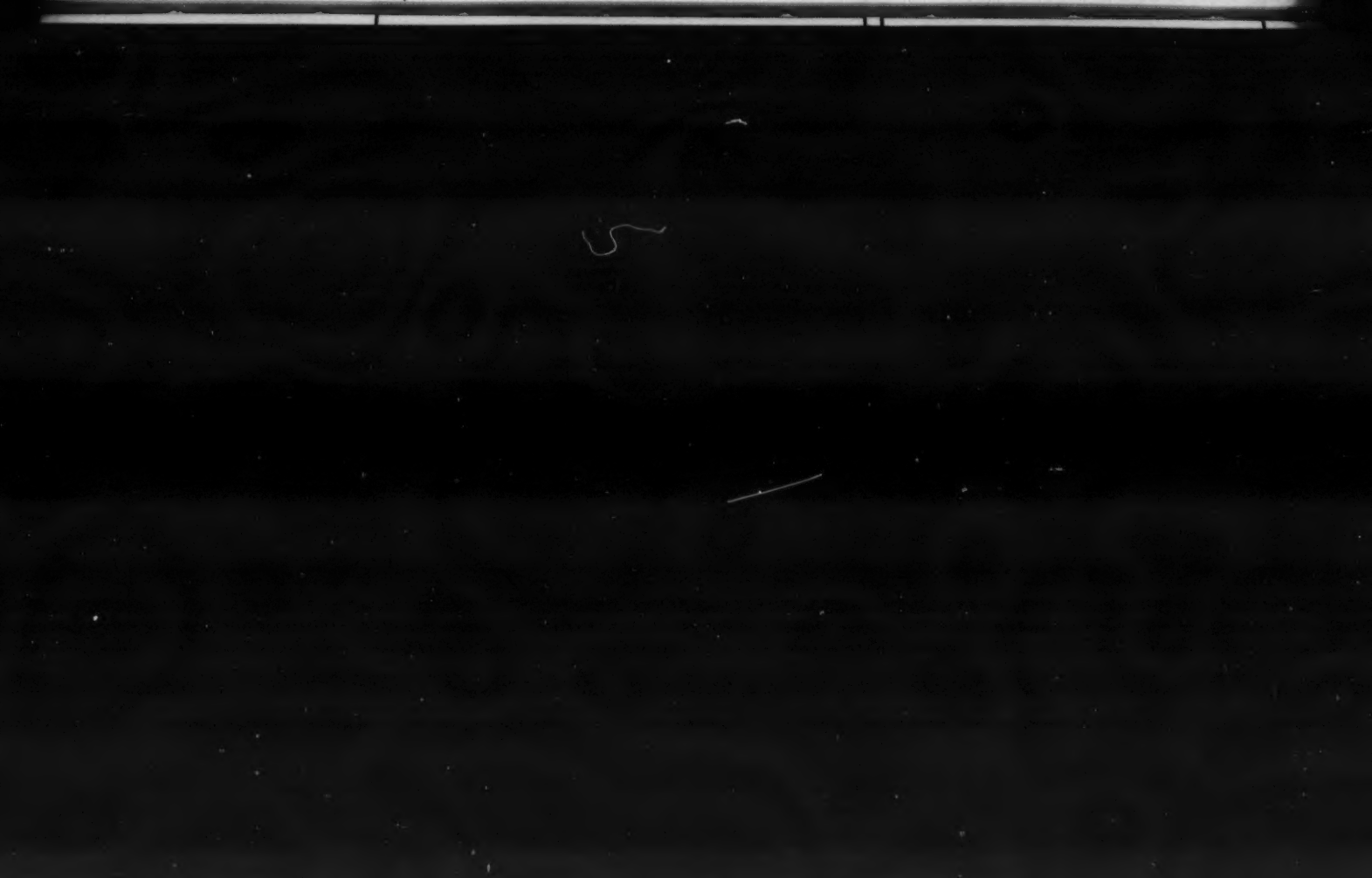

Decoding The Memory Molecules

Georges Ungar

Life represents an improbable state of matter that seems to challenge the second law of thermodynamics. Biological systems survive only because of their ability to absorb information—"to feed on negative entropy." The two sources of information are the genome—which contains the "general plan" of the organism—and the environment in which the organism lives and which determines its behavior.

If *hereditary* information is indispensable to maintain the continuity of life and the development of organisms, *acquired* information assures their adaptation to the environment. In the constant and limited environment of the "primeval soup" in which life was born or in the nourishing ocean where it attained maturity, the reactions anticipated by the genetic code were undoubtedly sufficient to maintain adaptation and survival. However, as organisms ventured toward less protected habitats, the stereotyped reactions programed by heredity became inadequate. This obviously requires a mechanism for the preservation of acquired information, the development of memory. It is probable that this stage of evolution coincided in animals with the appearance of a central nervous system capable of receiving, recording, storing, retrieving, and utilizing information.

The achievements of molecular genetics have had a profound influence on our way of looking at the problem of memory by raising the question of a code in which acquired information is registered, preserved, and processed in the central nervous system. The purpose of this article is to examine the neural code and to discuss the possibility that it, like the genetic code, is based on a molecular principle.

Evidence for a Chemical Code: The Role of Peptides

Although the chemical theory of memory has had several precursors, it could not seriously be considered before the acquisition of adequate biochemical knowledge. This point was not reached until about a quarter of a century ago, and it coincided with the introduction into biology of the concept of information and the possibility of its coding in terms of molecular structure.

One approach to the problem attempted to correlate chemical changes in the brains of animals with the acquisition of information. These experiments involved analysis of the nucleic acids and proteins. Their interpretation is often difficult, but on the whole they suggest that learning is accompanied by an increase of RNA and proteins in the brain with, perhaps, certain qualitative modifications.

A second approach has aimed at verifying the functional significance of chemical changes. If the metabolic increases are necessary for learning, their inhibition would disturb the consolidation of memory traces. Such disturbances were observed in animals treated with inhibitors of the DNA-RNA transcription (actinomycin D) and of the translation of RNA into proteins (puromycin, cycloheximide). Here again, interpretation of the results is controversial, but it is generally admitted that metabolic inhibitors prevent the consolidation of memory.

The third approach was inspired by the way similar problems (hormones, vitamins, neurotransmitters) were solved in the past by means of biological assay methods. If information furnished to a donor animal and the behavior that it produces are recorded in a molecular code, this could be detected by administration of a brain extract taken from the donor to a recipient animal whose brain would play the role of a decoding machine. In spite of some inherent difficulties, the biological assay today represents the only approach possessing the sensitivity and specificity required for the detection of coded molecules in the midst of innumerable other substances present in the brain.

Learning the Fear of the Dark

To illustrate the utilization of the biological assay method, I will summarize briefly a study done in my laboratory. Most rodents have an innate preference for darkness, and avoid light. This behavior can, however, be changed by inflicting pain (by application of electric shocks) to the animals when they take refuge in the dark. In our experiments, extracts prepared from the brains of donor rats that had acquired a fear of darkness were injected into recipient mice. The animals, although they never received electric shocks in the dark, changed their behavior after injection of the extract and avoided darkness instead of preferring it.

After having defined the conditions of training that yield the most active extracts, we accumulated 5 kilograms of rat brain in an attempt to isolate the active substance. Preliminary experiments showed that this substance was a peptide attached to ribosomal RNA by a labile bond.

After several steps of purification, we obtained a pure substance and determined its amino acid content. The analysis showed four residues of glutamic acid or glutamine, three of aspartic acid or asparagine, three of glycine, two of serine, and one each of alanine, lysine, and tyrosine.

The identification of a peptide is not complete without the determination of the sequence of its amino acids. It is in this sequence that the information is encoded, just as the meaning of a word is determined by the sequence of its letters. The small amount—300 micrograms—of substance at our disposal ruled out the classical methods of sequential analysis. Fortunately, a new technique based on mass spectrometry had just been developed, one suitable for the quantities of material available. After determination of the amino acid sequence, the peptide was reproduced by synthesis.

I gave the name "scotophobin" (from the Greek skotos = dark and phobos = fear) to this substance, which upon intraperitoneal injection at doses of 0.3 to 0.6 micrograms produces dark avoidance in mice. Intracranial injections of 0.03 to 0.08 micrograms produce the same effect in goldfish. The effect of the injection lasts 3 to 4 days. Samples of synthetic scotophobin have been distributed to several laboratories, three of which have reported results similar to ours. It is clear that the most urgent task now is the identification of other molecules capable of producing a specific behavior.

We started the isolation of two substances from brains of goldfish, one group of which had acquired preference for blue and aversion for green, while another group learned to behave in the opposite way. We shall probably need 20,000 fish brains for the identification of the substances. Comparisons between the chemical

structures of these substances with opposite actions will certainly be very instructive and we hope that they will contribute to the elucidation of the code.

The Principle of the Code

Few neurobiologists would deny today that acquisition and retention of information is accompanied by chemical changes in the brain. Most of those who concede the existence of these changes believe, however, that they reflect only an increased protein requirement for the formation of synapses or for the synthesis of transmitters.

Those who believe that the chemical modifications are specific for a particular learning and that they act to encode the information are divided on the fundamental principle of the code. One group of researchers tends to view the molecular code outside of the framework of the neural pathways. It would function like a magnetic tape on which information would be recorded by a new and unknown mechanism.

A second category of hypotheses sees the coded molecule as a transcription of the wave patterns carrying information. Even if we could be sure that the electrical phenomena contain all the pertinent information, it would still be necessary to find a mechanism capable of transducing electrical wave forms into specific molecular structures and to reconvert these into nerve impulses.

The third type of hypothesis is based on the "structural code," that is to say, information incorporated in the specific organization of the nervous system. The hypothesis I proposed in 1968 is based on this principle, but above all it is inspired by the concept of "chemospecificity of neural pathways."

The fundamental postulate of the hypothesis is that the system of innate molecular markers which directs the development of brain pathways can also serve for the coding of acquired information. Learning consists in the establishment of new connections between the preformed pathways to allow the nerve impulses to follow a new circuit. The information acquired in the course of learning can then be preserved by a combination of the labels that mark the pathways and thus becomes the codeword for the newly formed synapse. This creation of new connections and formation of coded molecules in which acquired information is recorded probably requires the intervention of a system of intermediary neurons.

It is possible that the labeling system of neurons is a special adaptation of a general biological process which allows cells of the same type to "recognize" each other to form specific aggregates. It is assumed that this recognition can be explained by the presence of specific proteins on the cell surface. As a result of the extreme differentiation of the neural cells, this mechanism could be more highly diversified in the brain than in the other tissues.

The memory code can therefore be regarded as an extension of the innate labeling system of the neural pathways. The elements of this system represent the vocabulary of the code and the little we know about it at present suggests that the amino acids form its alphabet.

The Superiority of Man: A Symbolic Memory?

One can ask at what point this hypothesis based on animal experimentation can be applied to man. Although the human brain possesses

the same basic design as that of all other vertebrates, its complexity is unequaled. It has acquired, in particular, the unique function of language, permitting the conversion of the universe into a symbolic system of representation and communication. It is probable that man possesses, superimposed on the primitive iconic memory common to all animals, a symbolic memory which may be the principal reason for his mental superiority. The use of symbols has made possible the transmission of information from one generation to another, first by oral tradition and later by written documents. The information thus accumulated has allowed us to construct systems of knowledge that would be impossible to imagine without the existence of language.

Without going so far as to revive the old belief in innate ideas, one can hold that the structure of knowledge is subject to constraints imposed upon it by the innate organization of the nervous system. One cannot fail to be struck by the parallel between the successive degrees of abstraction that characterize our ways of acquiring knowledge and the hierarchical levels of integration through which information must pass to be utilized by the brain.

The brain is often compared to an electronic computer. The comparison is apt, if we keep in mind that the operation of the brain is not based on an electronic process. The brain is a chemical machine whose energy is provided by metabolic reactions, in which the impulses are propagated by an ionic process and are transmitted from one neuron to another by chemical mediators and which, perhaps, is programed by a chemical code.

This concept opens new perspectives for the study of cerebral functions. It could supply means for correcting some of the defects of these functions, and perhaps for raising them to the limits set by the individual genetic potential. I am aware of the fact that the concept of a molecular code of the brain, like all new developments, also carries with it the germs of serious misuse. It could become an instrument of intolerable domination over the human spirit. The extent of this problem is difficult to evaluate at present, but in order to keep a sense of proportion, we should remember that the invention of writing, printing, and in our day, radio and television have presented the same menace. It is fashionable today to blame science for all the evils of our time and to forget all that it has accomplished to alleviate the misery of man. With a little more historical perspective, it may be possible to find ways that will permit science to continue to improve the human condition without endangering the values of civilization.

Condensed and translated from *La Récherche*, 19:19–27, 1972.
Reprints of original article from Georges Ungar, D.Sc., M.D., Professor of Pharmacology, Baylor College of Medicine, Houston, Texas 77025

Negative As Well As Positive Synaptic Changes May Store Memory

Mark R. Rosenzweig, Kjeld Møllgaard, Marian C. Diamond, and Edward L. Bennett

Shortly after the neuron doctrine was enunciated, the psychiatrist Tanzi in 1893 surveyed advances in neurohistology and hypothesized that learning produces anatomical changes in interneuronal contacts (which were to be named "synapses" by Foster and Sherrington in 1897), and that these changes serve as a mechanism of memory.

Most theorists during the intervening period have supposed that learning involves either the formation of new interneuronal connections or the strengthening of existing ones; few have thought of learning in terms of elimination or weakening of synapses.

We hypothesize that structural synaptic changes underlying learning and memory storage need not be of a single form, but rather may take one or more of four forms: increase in number of synapses, increase in size of contact areas, decrease in number, and decrease in size of contact. It would be expected that in any particular instance of learning, such changes would be limited to particular brain regions and to particular types of contacts; in fact, different changes may occur simultaneously in different sets of synapses in the same brain.

We have been using a procedure, including enriched or impoverished experience, which induces a variety of chemical and anatomical changes in the rodent brain and we have found that this produces clear synaptic changes. In our procedure, the main factor inducing cerebral effects is experience with a variety of stimulus objects in the enriched condition; the impoverished-experience animals are isolated but are not deprived of visual stimulation. The experimental conditions present opportunities for differential experience over several weeks. Control experiments have shown that the cerebral effects are not attributable to stress, locomotion, altered rates of maturation, endocrine involvement, handling, or to any brief irrelevant stimulation. Visual experience is not required to produce these effects since they occur with groups run completely in the dark and also in blinded rats.

Significant differences in size and number of synaptic junctions were found between littermate rats assigned at weaning to enriched or impoverished environments and kept there for 30 days. The synapses measured were asymmetrical axodendritic junctions in the neuropil of Layer III of the occipital cortex. Rats from the enriched condition showed, in comparison to littermates from the impoverished condition, synapses that averaged 48 percent greater in length but that were only 67 percent as numerous. The enriched rats had more large synapses as well as fewer small synapses than did impoverished rats, so the enriched condition size distribution could not have been derived simply by loss of small synapses from the impoverished condition distribution. The total area of synapses in the enriched group, taking both size and number of contacts into account, was 40 percent greater than in the impoverished group. The inverse effects between size and number of synapses in this study is similar to the relation

between synaptic size and number previously reported.

In another study, evidence of a positive enriched-impoverished difference in a number of dendritic spines (and thus presumably of synaptic contacts) on pyramidal cells in the occipital cortex of rats was obtained. Counts of spines were made on enriched-impoverished littermate pairs from four experiments with behavioral conditions similar to those of the preceding paragraph. On basal dendrites there was a 9.7 percent enriched-impoverished difference in the number of spines per unit of length along the dendrite. The counts of spines by light microscopy on cells stained by the Golgi-Cox method cannot be assigned to cortical layers for direct comparison with the preceding electron microscopic results. Electron microscopic counts in other cortical layers may reveal an increase in the number of junctions, or the relation between electron microscopic synaptic counts and Golgi-Cox spine counts may be more complex; only further research can answer this question.

When enriched-experience rats are compared with impoverished-experience littermates, they appear to have a lesser number but greater size in one population of synapses, and to have a greater number in another population. Experimental evidence from several laboratories is thus consistent with the hypotheses that stimulation and learning may induce increases in synaptic size and number, and it also suggests that negative as well as positive changes occur.

Our measures of synapses and of dendritic spines were made in occipital cortex because that is where we have found the largest changes in other anatomical and biochemical measures after several weeks of differential experience. Experiments with brief training by other investigators have shown chemical changes located especially in the hypothalamus. Some groups are recording the activity of single neurons at various levels of the brain during conditioning. Results indicate that the earliest changes during training occur in the reticular formation and in basal reward areas, with changes occurring eventually in the cerebral cortex. Thus, the chemical and electrophysiological observations both suggest a shift of locus from short-term effects involving motivational or reinforcing areas in basal regions of the brain to long-term storage, especially in the cerebral cortex. The chemical and anatomical changes that we find at the cortex may well represent the cumulation of innumerable small effects of learning during the prolonged differential experience.

We are not hypothesizing that the four types of synaptic changes are the only mechanisms for storing memory. In particular, some memories are formed very rapidly, and at least the initial type of storage is unlikely to be a structural change of synapses. Long-term memory storage, however, could well involve the positive and negative synaptic changes described here.

Condensed from the *Psychological Review*, 79(1):93–96, 1972. Copyright 1972 by the American Psychological Association, Inc.
Reprints of original article from Mark R. Rosenzweig, Ph.D., Department of Psychology, Tolman Hall, University of California, Berkeley, Calif. 94720

Simulation of Human Long-Term Memory

Nico H. Frijda

Although computer simulation aims to verify psychological theories, in actual fact, it has served primarily as a tool for developing theories. The construction of automatons able to achieve a given kind of performance implies the formation of a theory of that performance. Such a theory is plausible to the extent that constraints, derived from psychological data or from general biological considerations, are incorporated. This is the main function of psychological information in automaton construction; the data are too limited to permit straightforward translation into working models. Precisely for that reason is simulation a source of psychological hypotheses: Constructing a model requires the invention of mechanisms whose value as possible psychological mechanisms can then be examined.

Human memory is defined here as a system with content-addressable storage, a capacity to retain factual information, inference potential, and flexibility of retrieval potential. These four properties determine the nature of the models that have been developed. The components of a memory system are: an information store, recognition mechanisms, input transformation mechanisms, acquisition mechanisms, retrieval mechanisms, utilization procedures, and output construction mechanisms.

Information Store: An Association Network

The main component is the information store, and the capabilities required of a humanlike memory imply associative organization. Content-addressable storage can only be realized in this way. An item is associated with another item if presentation of the first gives access to the other. An associative structure appears indispensable for handling large collections of information of changing content, unorderly composition, and multiple purpose. Associative memories have been developed in work on artificial intelligence, and the development of complex information processing has hinged upon the construction of list-processing languages. Special associative systems and hardware have been evolved for information representation problems. An information store organized in an associative fashion consists of a network of elements. From each of the nodes, links lead to any number of other nodes. A node is represented by a list and its associations by elements of the list. Each list element may itself be a list, and so on.

Information Store: A Relational Network

At least three other characteristics appear to be needed: a relational structure, a hierarchical structure, and an implicit information structure.

Relational structure—Nearly all "question-answering" computer programs employ a mode of data representation close to the notions of "schema" or of "relational fact." In such programs the information store consists of a relational network of labeled links. The functional information element can be described as a complex consisting of two atomic elements linked by a relation: "rose, color, red." This functional element may be called an informational molecule and may be symbolized as (A,

R,B). The A,R,B complexes can be considered as cognitive schemas, and the relational network as a huge collection of such schemas, overlapping in their As and Bs. In this resulting network, there exist as many kinds of links as the number of relations that the system distinguishes. Programs with this kind of data structure can answer factual questions, affirm the truth of correct statements, solve verbal problems, maintain a dialog with a human subject, or verify assertions.

Structure with hierarchical features—The associations or, rather, relata of each node constitute the meaning of the concept or idea concerned: Each element of this meaning is itself defined by its environment in the network, and so on; clearly the network embodies the hierarchical structure of knowledege. The network is hierarchical in another respect. Each cognitive schema of the form A, R, B can itself function as a unity, and enter as an element in another A, R, B complex. The composite element is, thus, a subnetwork of the memory network, and elaborate informational structures can be built up in this manner.

Structure of implicit information—An important factor is the nonstructural, implicit organization determined by the nature of the relations constituting the network links. Although the relations have a meaning defined in the network as their environment of connected nodes, part of their meaning consists of rules of inference, which can be read as operations that the system may execute upon its data. Among the rules of inference are those that constitute the meaning of the logical relations and express their properties such as transitivities, symmetries, and reflexivities. The indicated meaning of the relations forms part of the total network in the same way as that of the elements related. Consequently, a relation may be interpreted just like any other element.

Information Store: General Comments

Alternative realizations of the model—The network model leaves open several important aspects. There are alternative ways to fill these out, and different theories or programs have chosen different ways. For instance, the links in the network may be one-way or two-way. Links may be made to vary in strength as a function of frequency or recency of utilization. The system may be given a distaste of redundancy, pushing each property as high up in the class hierarchy as possible and erasing that property at lower levels. Relations may be a few basic ones or as many as in the natural language. In most of these aspects, information on which a preference can be based is lacking, and experiments are needed.

Memory as a network of active semantic elements—The links in the network may be provided with an activity index that influences the probability of utilization of that link and molecule. Activity indexes may be influenced by several variables. They may be increased by current or recent activity of that link or by activity somewhere in a neighboring part of the network. An emotion or a desire also may have activating effects. Given a system with such activity indexes, memory may be conceived as a continuously active system that tries to express itself according to the hazards of its associational linkages and the reinforcement of its emotional orientations. External stimuli or tasks and intentions act only as influences that restrict, guide, canal-

ize, or control this spontaneous flow. This concept is supported by neurological evidence and theorizing, by free association, dream phenomena, sensory deprivation, and drug effects. But such a system needs rules for spontaneous activity decay which, so far, have to be rather arbitrary.

Nature of stored information—Utilization of memory may mean four things: purely internal activity, verbal output, nonexternalized output, or execution of internal and external action. Although all programs use words in referring to the contents of the information store, the stored elements are generally considered to be concepts or ideas as such. In fact, all programs use "internal names" for the nodes—internal names which are references to memory locations; only at the output stage are these transformed into ordinary words by means of special stored routines. This has an important consequence for the concept of the internal representation of information. Considering the way the model functions, the memory network is nothing but a system of access ways, which lead to procedures for the composition of words, of mental images, or to activities and operations. The network is, to some extent, a prescription to reconstitute them. No program, so far, has put any effort in realizing the reconstrution processes involved.

Sufficiency of the network model—The model, or class of models, manifests a minimum of structural order or organization. There is, for instance, no storage according to a hierarchy of classes and subclasses or no distinction between "associations" and meaning core. One may wonder to what extent such a model can form the basis for intelligent use of stored information.

Recognition Mechanisms: Communication between Input and Memory Store

To use a memory store, communication must be ensured between input and the contents of memory. Familiar information must be capable of locating and evoking its trace; new information must be recognized as such before it can be inserted. To locate a "memory trace," two methods are possible—exhaustive memory search, implausible in human memory; or "association by similarity," a process of resonance, in which the system has to search directly for a content that matches the input.

The entry zone of the memory network may be represented as a list of names and properties. Each element indicates a list that represents the network node of that element and which thus contains the R,B components of that element. Contact with the memory store is made by means of retrieval cues consisting of names or properties. The entry list of names and properties must be scanned to find the names or properties that match the cue. If the cue is a compound one—"what is an object which is red, fragrant, a flower, with thorns?"—the requested node is the intersection of the lists corresponding to the properties.

Input Transformation Mechanisms

A difficulty for the realization of a resonance process is the large variability of equivalent information. Most programs transform verbal information into a predicate calculus mode or into the format of network elements or its equivalents; figural information is translated into property lists which again may be in predicate calculus form.

Some of the question-answering programs require an input precoded into a standard format. In other

programs coding is executed by the program, either by a sentence-format matching or by elaborate syntactical analysis.

Acquisition Mechanisms and Storage Rules

The presentation of new information should lead to storage of this information. Acquisition mechanisms thus have to be specified, as well as rules defining under what conditions what information is stored, and under what condition it is not.

Discrimination involves the construction of traces of the elements composing the A, R, B molecules. The addition of other postulates turns this storage scheme into a coherent theory of acquisition: To the traces are linked retrieval cues, by means of which associations of the stimulus can be located through the same discrimination net; each elementary cycle of discrimination and construction of new tests takes a given amount of time to locate a familiar item in memory; there is a short-term memory of fixed small capacity; distribution of learning effort is in part governed by preference rules based, among other things, upon acknowledging anchor points among the stimuli.

With these postulates, the theory can explain several phenonema of verbal learning; simulation in fact produced these phenomena. It produced learning curves manifesting the serial position effect, the consequences of intralist and interlist similarity, generalization and retroactive inhibition, and response oscillation.

Another postulated process, an attention distribution strategy, produced an explanation and simulation of gradual learning in an all-or-none learning model. The program can choose between two strategies. It may try, with each stimulus presentation, to learn as much about that stimulus as it can; whenever a new stimulus appears, this replaces the old one in the immediate memory thereby interrupting the discrimination and learning of that replaced item. Or, the program may try to learn an item as completely as it can, neglecting new information. If the stimuli are not yet fully learned, the first strategy leads to gradual learning phenomena and the second to all-or-none learning.

In complex information storage programs, speed or ease of acquisition depends upon additional and highly relevant factors. In all question-answering programs, new knowledge is retained whenever it is presented. However, major efforts during acquisition have to be directed at inserting this new information into the memory network. Recoding the input must sometimes be based on an intersection between the new input and the stored information. For instance, one of the alternative meanings of a word "has" is selected on the basis of plausibility: if the subject of the word has already occurred as the subject of one of its meanings, this will be its most likely meaning now. If "John has fingers" is presented, and it is known that "Peter, has as parts, fingers"—not "Peter, possesses, fingers"—the first interpretation will be preferred.

The same interaction between input and stored information may be used to integrate new information. By linking it up at an appropriate place, available implications may become accessible and, therefore, the corresponding variety of access ways may permit subsequent recall. Locating new information in the network may be considered the major aspect of the process of "understanding" new input. Without it, new input could be

retained only as a string of words and retrieved only as such a string.

Still, in current fact-retrieval programs, acquisition is easy. One reason is the limitation of data stores and of inputs used, with consequent lack of proactive interference. Also most programs, by not distinguishing between words and knowledge per se, avoid many of the interactions. A third reason is the fact that fact-retrieval programs have indefinite patience, unwavering attention, and unlimited time. Time is, of course, an important constraint. The human system is confronted with a continuous stream of information, presented at a higher rate than that of processing. Consequently, the system needs strategies to control the sequence of processing, input selection, level or degree of recoding, condensing, etc. Not much systematic work on acquisition strategies has been done, either in psychology or computer simulation.

Basic Retrieval Mechanims

The basic tools for information retrieval are the retrieval cue and a matching process. The retrieval cue guides memory search, defining the kind of thing to be found, and serves as the post hoc criterion against which success of search may be tested. The retrieval cue is a compound stimulus with the form of an incomplete information molecule: A, R, ?, or A, ?, R; in a limiting case it may be A, ?, ?.

In simple information retrieval, memory is searched for a content that maximally matches the incomplete schema: "Amsterdam, is a, ?" may lead to "Amsterdam, is a, capital." The process is equivalent to "knowledge-unit completion" and has been considered the basic retrieval process. It is one of two fundamental memory utilization processes, the other being the truth request: "Amsterdam, is a, capital, true or false?" In both cases, the retrieval cue has a degree of organization that is absent in the stimulus constellations of more classical theories: the explicit mention of the functional relation between what is known and what is to be found.

With the help of matching and retrieval-cue completion, information retrieval may be trivial. It is in fact trivial on condition that the retrieval cue corresponds literally to some memory trace. In such a case, direct stimulus-response evocation or "immediate production of knowledge" is possible.

This condition usually does not apply. We have posited as a fundamental property of human memory its capability of evoking some of its contents when such literal correspondence does not exist. It should be possible to retrieve information not directly addressable by the retrieval cues. Without such a possibility, the system could not function in a natural environment even when provided with standard input transformation mechanisms. The system realizes this possibility by active search procedures.

Two descriptions corresponding to two concepts of cognitive functioning can be given of these search procedures: a goal-dominated and a diffuse activation conception.

In a goal-dominated model, the goal determines, from start to end, which steps are to be taken. Memory search is performed by searching for the requested kind of thing; if the kind of thing is found, the actual thing is evoked and, if the task requires it, further tested against the retrieval cue. This usually means that the list of the retrieval cue's key element is searched for the requested relation or something equivalent. If this relation is found, the B element

that belongs to it is retrieved or constructed.

A diffuse activation model resembles traditional associationist conceptions. Memory search is performed by retrieving all elements having to do with the retrieval cue's key element(s). If such elements are found, they are tested to check whether any of them is the kind of thing requested and, consequently, the requested thing itself. The method of locating elements "having to do" with the key element is to explore all possible associations: every element linked to the key element is tagged, or a unit of activation is added to its activation index.

Even with simple truth requests ("A, R, B"—true or false?) the models may give rise to different processes. In a diffuse activation model, activation starting in A may reach B, among others, and be detected by scanning B's own key list. If A and B are more than one node distant from each other, the stratagem also works. No such possibility exists in a goal-dominated model. There, the existence of a given B can only be detected by going down all the branches extending from the A-node and systematically testing each B encountered.

A diffuse activation model has properties which increase its plausibility as a psychological theory. Activation of the elements in the search set may irradiate into each of those elements' surroundings, extending to one or more nodes beyond the points of departure. Also, the build-up of an activation pattern on the basis of, say, a coherent story may yield an internal representation of that story's meaning. Coupled to the concept of a network of active semantic elements, diffuse activation permits information processing to be influenced diffusely indeed by aftereffects of earlier activity. Associative priming, set, etc. may thus be realized, and the course of free association can be made less implausibly capricious than otherwise. Finally, diffuse activation is a way to enable problem solving, or a course of thought, to change its goals because of chance encounters in the data—an event not infrequent in human thought.

Whatever the basic model, one problem in modeling retrieval is specifying priority rules for evoking the associations of a given node. Systematic search is not the most plausible procedure; stochastic drawing with replacement may have to be proposed. Preference based upon frequency or recency is the only guideline that psychology offers for weighting within such search procedures, and this principle is helpful to explain the order of evocation of meaning components.

Utilization Procedures: Information-Retrieval Strategies

Information retrieval is a relatively simple matter when there is a trace that matches the retrieval cue. If this is not the case, active search procedures have to be launched. These can be described as information-retrieval strategies—methods for transforming one task into another, possibly more easily solvable.

The simplest method to transform the retrieval cue is by interpretation. The retrieval cue is replaced by one of its meaning components, as this is present in the network, or the cue components may be transformed by operations indicated by those meaning elements.

The interpretation process continues until a retrieval cue is obtained that matches some trace. The

course of processing is governed by feedback of the difference between desired state and actual state of the problem; the desired state, in the present case, is an expression without a question mark.

Many information-retrieval tasks require more elaborate search strategies than simple retrieval. For instance, to solve verbal analogy problems, the system may be told to search for the relation between the first two words, then for a response word that stands in that relation to the third word.

Whether for straightforward information retrieval or for other tasks, the most powerful strategies use the data store's inference potential; they use the meaning of the system's relations and the rules of inference that belong to that meaning. Property requests (A, R,?) may be solved by means of the strategy: find a superordinate class of A (A, is a, X); find a property of this class (X, Q, Y); if this is the right kind of property, Y is the solution.

Strategies like these are not only used in, and useful for, problem solving, but they also function in neurotic belief distortion. The mechanism of displacement, for instance, transforms a belief into another belief, which is directed toward a different but similar object. Such an object is found by determining the class to which the original object belongs, and next finding another member of that class. "Me hates father; father is a man older than 40 years; Allen is a man older than 40 years; me hates Allen." The processes are plausible as simulations of human thinking; human thought, in fact, seems to move easily and willingly along the lines of hierarchies of classes.

This is an example of inductive inference. Inductive inference is, in many respects, within the capabilities of the system as described. In addition, explicit inductive inference rules can be used in evaluating credibility of a message or to extract new information from it: a psychoanalytically oriented system may derive "A, wants, Y" from the fact "A, fears, Y" by the rule "(A, fears, Y), implies, (A, wants, Y)." Expectations generated in this manner may serve to maintain some direction in a flow of association or of conversation.

The fact that inference rules are embedded in the data structure, and that problem-solving procedures are derived from that structure, embodies a point which should be emphasized. The intelligence of the system resides entirely in the data network. The point is of obvious psychological significance: it is not human thought methods that are powerful, but human knowledge. "Mental operations" are simple, but the content and organization of information are the main roots of intelligence.

Output Construction Mechanisms

Little can be said concerning output construction. Word construction is a trivial, nonsimulatory process in nearly all programs. Word finding or naming, too, is usually trivial. In all programs a name is attached to each stored element (or no distinction between names and stored information elements is made). Sentence construction occurs in several programs. Output construction would seem an important aspect of information processing generally, since outputs, particularly of tentative solutions, are usually fed back into the system, influencing its further processing in a poorly understood manner.

Forgetting

Little mention has been made of forgetting. The question may be asked whether forgetting mechanisms should be incorporated into memory systems, since it is so striking a feature of human memory, or how forgetting can otherwise be understood, in the context of these models.

Some forgetting may appear without any special provisions because memory, in those models, is not a static structure. Most programs add the results of information processing to the memory store. This change does not always result in increased power. The growth of a discrimination net may result in a loss of previously correct associations. Forgetting of such displaced traces occurs: although the traces are there, they have become inaccessible.

Forgetting can be obtained in other ways. If the number of associations of a given network node increases, and if associations are selected randomly, probability of evocation of each association decreases. Such forgetting will be more effective if strength measures influence that probability. Another mechanism for forgetting may be found in multiple connections between the nodes. If the system provides for propagation of activation and if the activation of a given node depends upon the number of activated links that end in that node, learning of new associations between nodes may eclipse previous learning of other associations.

To increase the dynamism of the system, the associations of a given node may be collected in a "push-down-stack," which is one simple method to implement availability indexes. Information is stacked in order of arrival; this order may be changed by usage, and only the topmost element is accessible; or the probability of evocation may be made proportional to the serial position in this stack. These mechanisms provide for nearly complete forgetting of old and little used information. Accessibility difference based upon order of arrival has, in fact, a certain plausibility.

Summary Overview and Empirical Evaluation

Through this ensemble of programs, the outlines of a more or less coherent model of memory have become visible. This model consists of a large network of associations in which the nodes refer to the ideas, and the links to the relations between those ideas. The ideas may be simple or may be composed of small networks that manifest complex and unorderly interconnections. The network should be considered as a system for the addressing of reconstruction of inputs, rather than as containing any sort of reproducible trace of those inputs. External stimuli obtain contact with this network by way of a discrimination process that is governed by a discrimination net, or by parallel property matching; in this process, the stimuli are transformed so as to correspond with the internal mode of information representation, a transformation which is produced in interaction with the content of the information store.

The memory is used with the help of retrieval strategies that trace a path in the network, guided by the retrieval cues inherent in the tasks or aims. This memory utilization may be superimposed upon a spontaneous activity which is modified by the search activity and which itself may modify that activity. The strategies are, in part, compiled on the basis of the memory itself, and of the task or aim at hand.

This model is mainly the outcome

of constructive efforts that have sought to establish a system manifesting capabilities that are essential in human memory. The efforts have been guided in part by psychological hypotheses, such as those of spontaneous activity; they have been guided mostly by the demands of the goal—construction of a useful memory store—and by the kinds of data involved: complex, structured, and interdependent information. The model does show similarity with recent psychological theories on human memory. The similarity is not coincidental: most of these theories have been influenced by computer programing work.

As far as empirical evidence is concerned, the model accounts for a number of phenomena of human memory activity. Central to the model is the A, R, B structure as the basic mode of information representation. This hypothesis finds support in evidence concerning the importance of imagery, or generally, of mediators in paired-associates learning.

The conception of a relational network fits in well with work on association structures. It is in agreement with the thesis that information utilization is based upon relations between meanings, and upon meaningful relations, rather than upon contiguity relations between words.

The hypothesis of a network with a near total lack of structural differentiation is plausible as a psychological theory; direct evidence would be hard to come by, however. There is even some support for the notion that the relations of concepts with classes and properties (rose-flower or rose-red) are represented differently from those between independent concepts (rose-tulip or rose-nursery).

Input transformation as a preparation for recognition and storage is a plausible hypothesis for psychology. Interaction between input transformation and the information already stored also may be a major feature of human cognition.

Recall, in the model, is highly dependent upon retrieval cues and their nature. This central place of the retrieval cue in recall corresponds with its importance. The essential difference between recognition and recall parallels that between retrieval with a literally matching cue and with an insufficient or incomplete and nonmatching cue.

The importance given in the model to such information-retrieval strategies is in line with recent experimentation and interpretation. Effects of organization in presented lists are easily interpreted as results of more efficient search strategies. Human information-retrieval activity is permeated with the application of complex information-retrieval strategies. Immediate production of knowledge in recall would seem an exception rather than the rule, even in relatively simple recall tasks, and it would seem the rule only in the simpler of recognition tasks.

Influence processes appear to play an important part in recall and to merit much more emphasis than they commonly receive. The importance of inference processes is underscored by evidence in the development of memory. In fact, the "spontaneous" improvement with age of specific recollections is explained in terms of the model: elaboration of the meaning of the various relations will automatically improve recall.

The possibility of deriving problem-solving methods from the data structure has some interesting psychological implications. Since the compo-

sition of the data store may determine which operations are performed at each point of the problem-solving course, this course is dependent upon what the relevant data happen to be composed of. The variety of problem-solving procedures usually found with human subjects in the same problem-solving task, and the subtlety with which they appear to capitalize upon specific properties of the actual problem situation, thus become intelligible.

This is about as far as the supporting evidence goes. For many aspects the psychological evidence against which to test the model is lacking or fragmentary. Conversely, the simulation model is as yet too general to permit many specific predictions to be made.

The value of at least some of the model's basic notions is attested by the success of simulation: first, the effective production of some of the major phenomena and, in particular, the emergence of correct answers to factual questions in nontrivial ways. However, the significance of these successes should not be overestimated. The various results—inferences, synthesis of strategies, effective problem-solving, generalization, and interference phenomena, etc.—have been obtained in different programs. It is impossible to predict what will happen when someone undertakes to unite the principles of each program into one big one. Moreover, all programs have, so far, operated only with small information stocks; their functioning may well collapse if larger stocks have to be processed.

On the other hand, simulation is beginning to manifest its usefulness as a stimulator of experimental research; moreover, the research that has been stimulated tends to support the model's notions.

The model shows several deficiencies. All concern the absence of properties, which, so far, have not been demanded by the requirements of task performance, but which occur in human memory. Short-term memory has been neglected. Forgetting in long-term memory is the second major omission. The same holds for everything that is time dependent; no estimate of old or older can be made, or any consequence of it produced, except by means of an extra "time-line."

At the level of understanding much is left to be done. For one thing, no program rejects a question such as, "is the idea green?" as meaningless. No program is meaningfully able to say no to an incorrect question of fact, such as, "is an apple square?" The entire manipulation of denial or mutual exclusion ("is the apple square?" "no, it is round") is, where it exists, primitive and preprogramed. Yet, even in these connections the model is useful for bringing these matters into sharper focus as cardinal aspects of human information storage and information manipulation.

This extensive review has a 142-item bibliography.

Condensed from the *Psychological Bulletin,* 77(1):1–31, 1972. Copyright 1972 by the American Psychological Association, Inc.
Reprints of original article from Dr. Nico H. Frijda, Psychologisch Laboratorium der Universiteit van Amsterdam, Amsterdam C, Netherlands.

Rehearsal and Storage of Visual Information

William O. Shaffer and Richard M. Shiffrin

Studies of recognition memory have raised questions concerning the similarities and differences of the verbal and visual memory systems and what processes and mechanisms can account for a high degree of visual information storage. Investigators have concluded that pictures are processed in memory one by one for exactly the duration of presentation, but when a list of verbal items is presented, the physical exposure time of any item is virtually irrelevant.

Some experiments have focused on backward masking as a factor which hinders memory of sequenced visual presentations, and results have suggested that study time between presentations may facilitate memory processing and storage of visual materials. The following experiment was conducted to examine this hypothesis.

The subjects were undergraduates at Indiana University. They viewed 120 different slides divided equally between two presentation trays. Duplicates of 60 of these items and 60 distractor items were used to construct two test trays. Each tray consisted of 15 items from one presentation tray, 15 items from the other presentation tray, and 30 distractor items. Slides were numbered and assigned to presentation or test trays according to a random permutation of the numbers. The pictures included furniture, machinery, jewelry, paintings, toys, cars, plants, houses, outdoor scenes, etc.

The subjects viewed the two presentation trays and then gave confidence ratings while viewing the two recognition test trays. The five values for exposure time ("on time") were orthogonally combined with three values for between-slide durations ("blank times") to yield 15 presentation conditions.

The presentation conditions were assigned to serial positions according to a modified randomized block design. Each presentation condition appeared twice in each block of 30 slides—once on a to-be-tested item and once on a not-to-be-tested item. During the presentation phase slides were presented sequentially after randomly selecting starting points. For the recognition tests, items were tested in random order.

For the recognition tests, subjects were asked to indicate their confidence about whether or not they thought they had seen a slide during the presentation phase by pushing one of six buttons. The buttons were labeled, and they formed a six-point scale: The left-most button indicated certainty that a slide had been seen before and the right-most button indicated certainty that a slide had not been seen before. Subjects were told that about one-half the test slides would be new, and a special instruction was read to them to emphasize the use of blank time. The response interval terminated when all subjects had responded or after 15 seconds, and was followed after 4 seconds by the next test slide.

Analyses of the data show that the mean confidence rating for all pictures presented during the study trials was 4.95, and the mean confidence rating for distractor items was 1.73. Thus, subjects had little difficulty with the task.

The mean confidence ratings as a function of "on time" and "blank

time" showed no effect due to blank time. As expected, the relationship between confidence ratings and on time was monotonic and increasing. A factorial analysis of variance showed the on-time effect was highly significant and accounted for 26 percent of the total variance; the blank-time effect did not approach significance and accounted for none of the variance; and the interaction of blank time × on time was significant but accounted for less than 2 percent of the total variance.

The lag between presentation and test could range from 1 to 240 items. Dividing this range into four blocks revealed a slight decrease in confidence ratings as the retention interval increased. Despite the slight advantage for items tested quickly, however, performance is relatively stable even up to 200 or more items and for about 25 minutes between presentation and test.

A final interesting point is the absence of serial position effects. There was no primacy effect, and there was little evidence of a recency effect, even though the last four items were always among the first eight items tested.

The amount of blank time following the presentation of a complex visual stimulus has no effect as long as the blank time is at least 1 second in duration. This result is quite different from results of experiments using verbal materials, and the use of relatively long blank times rules out backward masking as a cause of the differences. Also, this result was obtained despite explicit instructions to use the blank time to "think about" and "try to remember" the previous slide.

There can be no analog of verbal rehearsal in the visual memory system that can be applied to moderately complex visual stimuli. If rehearsal were occurring, longer blank times would have led to better performance; also, the absence of a recency effect provides further evidence that rehearsal is not occurring.

We do not imply that rehearsal is a solely verbal process; visual rehearsal *does* seem to operate where the visual input is of low information content. Thus, the difference between prior experimental results and the present results seems to lie in the differing information content of the stimuli used.

These results tend to blur the theoretical distinction between the iconic memory and the short-term visual memory. Many memory theorists assume that after the stimulus has been presented, a sensory image is held very briefly in the sensory register, it then is temporarily transferred to the short-term store for further encoding and rehearsal, and finally it is transferred to more permanent long-term storage. Our results suggest the more parsimonious view that there is just a single short-term visual memory. This short-term visual memory would decay quickly when the information content of the visual field was high, and more slowly when the information content was greatly reduced.

Condensed from the *Journal of Experimental Psychology*, 92(2):292–296, 1972. Copyright 1972 by the American Psychological Association, Inc.
Reprints of original article from Richard M. Shiffrin, Ph.D., Department of Psychology, Indiana University, Bloomington, Ind. 47401

Slow Potential Concomitants of the Retrieval Process

Eugene H. Rubin and Dale W. McAdam

The readiness potential is a slow negative potential shift that precedes a motor movement. The amplitude of the wave varies with motivational states and perceptual accuracy. Topographical aspects have been explored, but analyses have focused on motor and premotor areas of the frontal lobe and have left unexplored temporal regions and much of the parietal and occipital lobes. Since both frontal and temporal areas have been implicated in memory processes, we studied response-related potentials from temporal, frontal, and central sites in an experiment on memory retrieval.

Subjects were volunteer undergraduates. After electrodes were applied, they were given 5-minutes to look over a list of 175 words. The words were all relatively common, of approximately equal usage, and four to six letters long. After the 5 minute inspection, subjects were told that another list of words would be presented singly with brief tachistoscopic exposure. Half of the flashed words were on the first list. Subjects were to classify each word into one of nine categories: Categories 7–9 meant that the subject recognized the word as being on the list, Categories 4–6 that subject was not sure, and Categories 1–3 that subject did not think the word was on the list.

We found that wave forms preceding a subjectively "certain" response differ significantly from those preceding "uncertain" responses over the temporal lobe. This effect was not observed with the frontal or central electrodes. The wave preceding the 7–9 responses had response potential as well as a significant positive. Two results indicate that these differences correspond to subjective as opposed to objective recognition factors: There was no difference in response times between the 7–9 and 4–6 groups; the number of words that were on the list when the subject thought he recognized them did not differ from the number on the list when the subject did not know if he recognized them.

Three indirect lines of evidence indicate that these waves are not purely a function of motivation/activation/attention variables: Reaction times did not differ between the 4–6 and 7–9 responses; there were no differences in the vigor of the response; and no responses were seen at the vertex, a location which has tended to reflect these variables.

These potentials appear to be related to subjective evaluation of the scanning process. This is different from, although related to, the scanning of information and correctly retrieving stored information. The localization of this differential effect over the temporal lobe is interesting in view of clinical findings relating this region to memory functions.

Condensed from *Electroencephalography and Clinical Neurophysiology*, 32(1):84–86, 1972. Copyright 1972 by Elsevier Publishing Company.
Reprints of original article from Dale W. McAdam, Ph.D., Department of Psychology, University of Rochester, Rochester, N.Y. 14627

The Contract of Secrecy

G. Raymond Babineau

One way in which a group may define its membership is by the possession of information to be kept secret from those outside the group. In such groups, the issue of loyalty revolves to a great extent around the maintenance of the contract of secrecy. Since World War II, military and civilian intelligence agencies, whose members live with a contract of secrecy for a tour of duty or for an entire career have proliferated. Also, increasingly, psychiatrists are asked to make a judgment as to whether a person should be granted a security clearance. This paper delineates some relevant psychological themes in such individuals and groups. It is based on 3 years' experience as an army psychiatrist in West Berlin, involving consultative work with over 250 individuals, military and civilian, whose assignments were of a highly classified nature.

The Fantasy of the Work

Occupational skills required in intelligence agencies are quite diverse. Today's spy for example, could be a physicist, chemist, engineer, counterfeiter, electronic expert, airline pilot, farmer, weaver, television director, or female impersonator. It is a vocational problem to attract and prepare candidates for work they have never experienced. This is particularly true with secret work, where fantasy and wishes may be unmodified by realistic information until the person is actually on the job.

A less military life—At the time of recruiting or induction the candidate for a military intelligence unit may be asked to obligate himself for an additional length of service, in return for which he will receive intensive technical or language training. Beyond this, recruiters often foster the expectation that being assigned to such a unit will be a way to circumvent unpleasant military tasks and some of the more rigorous aspects of military dress and discipline. The greater the discrepancy between the fantasy of what the work will be like and its actual nature, the greater the potential for dissatisfaction and annoyance.

Dreams of glory—The fantasies motivating enlistment in intelligence units seem to come partly from spy and intrigue novels and movies, as well as occasional sensational news disclosures. When asked directly, the candid intelligence worker will often admit that although he may have had some rational doubts, *underneath* he had vague but active expectations of a life of intrigue, charged day-by-day with the tension of dealing with top secrets.

The reality of routine intelligence work is usually something quite different. As in other situations, it turns out that it is not so much phallic-narcissistic traits which are rewarded, but obsessional ones. Precision, patience with repetitious tasks, gratification with performance of relatively mechanical procedures, teamwork, are attributes which are likely to characterize a dependable intelligence worker. The chances, therefore, are high for assignment mismatch and job unhappiness. Commanders report that at times of emergency, when data of great importance are being gathered, morale is highest.

One attraction and complication of intelligence work is that it gives the individual some exemptions from

what is considered socially normative. Details about one's work can and must be withheld from outsiders. This may be a problem in the sense that one cannot share with wife or friends the content of the workday; complaints about this are frequently heard. However, those who complain the most about this are also the ones who exaggerate the secrecy and the importance of their work. They are insecure individuals who seem to be saying to others, "My work is so intriguing, important, and demanding you would be fascinated and impressed if I only could tell you about it. Unfortunately I can't, and you must remain tantalized but ungratified."

This style may also become a method of rationalizing about neurotic difficulties. Over the years, more and more intrapsychic or interpersonal problems may be swept behind the screen. Marital difficulty is another type of problem which is frequently rationalized on the grounds of secret work. For those men who have difficulties with intimacy and the demands which a family may make, secret work can provide a means of erecting needed boundaries between the man and his wife.

Another way in which secret work takes the individual out of the usual system of social constraints and obligations is that his work gives him the "need to know" justification which is withheld from others. Natural curiosity about secrets is not only justified but one need feel no guilt about either the curiosity, listening in, or peeping into what is usually considered secret. There is also the theme that knowledge equals power or control. I have seen a few young intelligence workers who eventually felt repelled and guilty about these aspects of their work. Much more frequent is either the scopophilic gratification which comes from "tuning in" to what is secret or the boredom and disappointment which may result from discovering that one's curiosity is never fully gratified.

For some intelligence workers, sharing of truth concerning their work is not problematic in that they rigidly withhold all information from friends and family. This is most readily done if the work is routine, repetitive, and at the same location. But agents in positions of greater responsibility often have more mobility, irregular hours, and travel, and absences from home for days or weeks cannot be fully explained.

Some agents break the rules regarding secrecy and selectively tell their wives somewhat more than they are supposed to. The same may be done to solidify a relationship as a significant act of trust. In my experience this selective breaking of the constraint of secrecy was not done out of deficiency or lack of loyalty, but rather was done by mature well-integrated individuals who could not tolerate the isolation that total secrecy implies. Even if an intelligence agent reaches a modus vivendi with his wife regarding his work, a difficult problem remains regarding children.

In exploring the developmental meanings of secrets, there are psychoanalytic considerations: For the child, secrets may be earliest associated with bodily secretions (which are retained or surrendered). Later, the possession of a secret may be equated with the possession of genitalia (secret parts, which are concealed or exhibited, by children and adults); the content of a secret must be differentiated from the state of possessing a secret; a secret is a potential gift to be used in cementing relationships.

As the child develops, the historical

antecedents of a defensive style become more difficult to identify. Though still operative, they have changed in function. Maintaining secrets may aid in identity formation and help guard against identity diffusion. Choosing to work in the realm of secrets means selecting a reality situation which interdigitates with one's own adaptive needs.

The person who lives with a contract of secrecy becomes intimately involved with a strong psychological defense. He takes an exempt status from interpersonal intimacy in his work and to an extent in his personal life. There exists a spectrum of human need in the realm of intimacy, individual distancing, armoring and "territory." In this spectrum, secrecy can be used appropriately as a tool to create the necessary conditions for personal relationships. It also has potential for causing psychopathological disturbance when used excessively or inappropriately.

Consultative Service

In the military services, the attitude has been taken that most psychiatrists do not need to have special briefings or direct knowledge about intelligence agencies in order to give professional service to members of those organizations. This has seemed acceptable, at least for the evaluations and brief psychotherapy which are usual for the military psychiatrist. Knowing that the invoking of secrecy by the interviewee is frequently done for defensive purposes should help the interviewer in not taking this with excess seriousness. His job is still the usual search for psychological factors. For more intensive treatment efforts, it is better to have a "cleared" psychiatrist. The psychiatrist who has been cleared has the advantage of being able to challenge official secrecy when it is used as a resistance against the exploration of personal secrets.

In his professional development, the psychiatrist develops some expertise in bringing to light the secret problems of his patients. Both the reality of professional competence and the fantasy expectation that the psychiatrist may ferret out secrets the patient does not wish to disclose add a considerable burden to the intelligence worker approaching consultation. Knowing that he is talking to a cleared psychiatrist helps diminish some of this superego anxiety.

Countertransference complications may arise when a patient insists on his right to secrecy. Prior to being granted clearance, I responded to intelligence workers as if their invoking of official secrecy was an act of aggression toward me. For some time after being granted a clearance, my counteraggression took the form of vigorous challenging of any use of official secrecy in consultative sessions. The difficult task, for the worker in official secrets, as well as for the psychiatrist, is neither to overestimate nor underestimate secrets, and to integrate the contract of secrecy into his personal and professional life.

Condensed from the *Archives of General Psychiatry*, 26(1):15–18, 1972.
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Reprints of original article from G. Raymond Babineau, M.D., Department of Psychiatry, University of Rochester School of Medicine and Dentistry, Rochester, N.Y. 14620

Biomagnetic Phenomena: Some Implications for the Behavioral and Neurophysiological Sciences

Frank Russo and Willard E. Caldwell

The earth's magnetic field has been of interest since 1835 when Gauss measured its parameters, but until recently, it remained under the scrutiny of the physicist alone. Biophysicists now have turned their aim toward the magnetic phenomenon and its effect on biological processes, and there has evolved the field of biomagnetics wherein physiologists and psychologists, as well as biophysicists, are exploring the intricacies of biomagnetic phenomena.

The discovery of magnets and magnetism occurred during the Iron Age when magnetite, an iron ore, was found to hold this awesome and mysterious power. From the time of its discovery, the lodestone was believed to have miraculous healing powers.

The doctrine of animal magnetism reached its pinnacle in the 18th Century when Mesmer introduced the healing art of *mesmerism*. Mesmer experimented with the effect of magnets on the human body and found that by stroking the body with metal magnets he could induce a state later known as hypnosis. Later he abandoned the use of magnets, finding that the utilization of his own animal magnetism was sufficient to affect a cure. However, since Mesmer could not disclose the "secret" of his method, other than through the "power" of his own animal magnetism, the French Government denounced him as a fraud and charlatan. Since biomagnetism is so closely associated with animal magnetism, it is understandable that it would cause some apprehension among psychologists and physiologists.

Space scientists are becoming concerned with the problem associated with isolating man from his natural environment. At first, their interests were directed mainly toward the problems of gravitational effects on the astronaut. Now, concern has shifted toward the relatively subtle problems of changing magnetic influences.

Many studies with a wide variety of animals and organisms subjected to a wide range of magnetic field strengths and configurations have in general concluded that

- artificial magnetic fields do indeed affect biological organisms through their physiological processes;
- the effect is quite general since it affects the total rather than specific parts of the organism;
- the effect is most probably due to interference with physiological control of inhibitory processes that are of an electrical nature; e.g., neurophysiological and humoral ionic processes;
- the "compass" behavior exhibited by some animals may in essence be an attempt toward reducing this disorganizing effect.

People are becoming aware of the "unseen" environment about them. National programs instituting controls for air and water pollution and for nuclear testing are concrete instances. However, man remains oblivious to other silent and subtle aspects of the environment, the physiological effects of which may have far greater significance. He swims in a geomagnetic environment which waxes and wanes with the cosmic tides, stands naked before the rays of cosmic radiation

that filter through the magnetosphere, and walks unsheltered in a shower of microscopic meteorites that bombard earth from outer space. Such events, because of their global aspects, pass unnoticed, since through a million-and-a-half years of evolution, these natural events have determined the design and course of his being.

In the past, the magnetic field reversed several times, subjecting all living things to a lethal shower of cosmic radiation spewed forth by the Van Allen belt. In the future, as calculated from the field's present rate of decay of 5 percent every 100 years, the earth's magnetic field is expected to reverse again about A.D. 3991.

Although the environment continually changes, its change is gradual, permitting time for adaptation. But, what will happen if man, through his own contrivances, changes the environment at a rate faster than his ability for adaptation. For instance, since the invention of the radio in 1895, man has developed a massive number of radio and television stations throughout the world. Also, with the advent of the satellite, he has extended further his range of communication over the earth and space. The electromagnetic emissions from these stations blanket the earth with continual pulsating and fluctuating waves of energy. Through the increased saturation of the ether with electromagnetic radiation, could man, some day, begin to suffer from "ether pollution?" On the other hand, having attained a level of adaptation to this saturated environment, could he, without ill effects, be transported from his present environment into one free of radio emissions?

The space-age man will soon become enlightened to questions regarding himself, his world, and their relation to the universe. Outer space will prove the ultimate challenge. In space, as he travels from one magnetic environment into another, he may perceive change on a neural level due to shifting neural potentials.

The space program has increased its scope of research to include biomagnetic phenomena. As a result, many aspects of biomagnetic phenomena will be carefully scrutinized. Principally, among these aspects is the question of impact on human psychological and physiological functions owing to changing magnetic environments. When exploring the surface of a foreign planet, will the astronaut need to carry a self-contained magnetic environment, as well as his oxygen and pressure equipment? Present experimentation in biomagnetics warrants exploration of these problems—problems that concern not only the physiologist and biophysicist, but the psychologist as well.

Note: This condensation is essentially a brief summary of a 77-page monograph with a 45-item bibliography.

Condensed from *Genetic Psychology Monographs,* 84(2):177–243, 1971.
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Facilitated Aggression in the Rat Following 6-Hydroxydopamine Administration

Burr S. Eichelman, Jr., Nguyen B. Thoa, and K. Y. Ng

Catecholamines have long been implicated as playing an important role in the modulation of aggressive behavior. One model for the study of animal aggression is that of shock-induced fighting. This model pairs two rats in a small enclosure and subjects them to inescapable footshock. The rats will attack each other. Since many pharmacological agents studied in this paradigm have diverse mechanisms of action, 6-hydroxydopamine (6-OHDA) was studied. This drug causes depletion of catecholamines in the brain, impairment of uptake mechanisms, and degeneration of nerve terminals.

Experiment 1

The animals were 32 male rats. The shock-induced fighting apparatus consisted of two Plexiglas boxes with stainless-steel grid floors. Shock was delivered by a constant current source for a duration of 0.4 seconds every 7.5 seconds.

On the first day of the study the rats were randomly paired. For the first 3 days they were subjected to daily sessions of shock-induced fighting. These consisted of delivering 50 footshocks to each pair of rats and counting the number of attack responses made. Aggressive attacks were defined as a directed movement toward the opponent which resulted in contact, including at least one additional response: biting, sparring, upright attack posturing, or supine submissive posturing, adopted by the attacked rat. For each day, an attack/shock percentage was calculated. This daily percentage was then averaged to provide a baseline.

On Day 5 under light ether anesthesia, 32 rats were injected intracisternally with 6-hydroxydopamine hydrobromide. Sixteen rats were injected i.c. with vehicle. The animals were refought on Days 8-10. Four 6-OHDA pairs at this point received mouse-killing and jump testing, following which they were sacrificed. The remaining six 6-OHDA pairs and the saline controls were retested on Days 15-17. On Day 19 the 6-OHDA group received a second i.c. injection of 6-OHDA. Both groups were fought for the last time on Days 22-24. Changes in shock-induced aggression were determined by comparing each pair's weekly baseline with the previous week's baseline.

Jump thresholds were obtained for all groups. Each rat was given ten series of unavoidable shocks through the grid floor. Each series consisted of six shocks of graded intensity. The ten series of shocks were presented in alternating ascending and descending order, with the first series for each animal being an ascending one. A jump threshold for each rat was obtained, being the lowest current intensity at which the rat jumps 50 percent of the time. The control group was compared with the 6-OHDA group.

Upon completion of jump thresholds, the rats were moved to individual cages. Following a 2-day period an adult mouse was placed in the cage for 24 hr. The number of mouse-killing rats was recorded for each group. At the termination of the experiment, the rats were decapitated, their brains were rapidly removed, and assays for whole brain dopamine

(DA), norepinephrine (NE), and serotonin were made.

Three days after the intracisternal injection of 6-OHDA there was a marked increase in shock-induced fighting in the experimental group. Mean fighting levels significantly rose from 9 percent to 38 percent. This effect increased further to 42 percent during the following week. A second dose of 6-OHDA raised mean fighting levels still further to 57 percent. There was no significant increase in fighting in the saline controls over this same period of time. There was no ataxia, no increased irritability, and no increased spontaneous fighting when this drug was given alone at the above dosages. Jump thresholds between experimental and control groups were not significantly different. One of 18 6-OHDA rats as well as two control rats killed their mice.

Whole brain amine assay demonstrated significant depletion of both dopamine and norepinephrine after dosage of 6-OHDA. This depletion was greater with a second dose. Serotonin was also significantly lowered in this paradigm after two injections of 6-OHDA.

Experiment 2

In order to provide a replication for Experiment 1 as well as to ascertain whether one rat of a pair could effect this increase in aggression, a second experiment was undertaken. The animals were 16 male rats. The apparatus and method were identical to that of Experiment 1. Once again there was a significant increase in shock-induced aggression, from a preinjection baseline of 12.5 percent up to 31.4 percent.

This study demonstrates a significant increase in shock-induced aggression following the intracisternal injection of 6-OHDA. This effect is significant even if only one member of a pair is injected. This increase in attack rate is persistent and correlates with the depletion of whole brain DA and NE. The observed increase in attack over time further appears to correlate with the time course of adrenergic nerve terminal degeneration. The decrease of brain serotonin observed following two consecutive injections of 6-OHDA remains presently unexplained since previous studies have not found this decrease. This decrease may be related to the high levels of fighting seen in these 6-OHDA rats.

This increase in shock-induced aggression following 6-OHDA appears to be primarily a facilitation of what has been termed irritable aggression. The increased aggression suggests that DA or NE systems play a functional role in the inhibition of shock-induced attack behavior. The depletion of DA or NE in itself may produce the observed effect, or this effect may be the result of an imbalance of monoamines such as between indole and catecholamine systems.

Condensed from *Physiology and Behavior,* 8(1):1–3, 1972. Copyright 1972 by Brain Research Publications, Inc.

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The Coffee-Pot Affair: An Episode in the Life of a Therapeutic Community

Walter H. Bradshaw, Jr.

In their Book *The Mental Hospital,* Stanton and Schwartz documented cases of pathological excitement in patients who were the subjects of covert staff disagreement about management. They observed that only two staff members usually were involved, and that the excitement subsided as the conflict moved toward resolution. Over the years similar cases have been noted and what came to be known as the Stanton-Schwartz phenomenon was accepted as a fact of therapeutic community life.

An interesting variant of the phenomenon was demonstrated at Bronx State Hospital. This paper focuses on the events surrounding its appearance, and on the issues related to class and status, race, sex, and professional roles and identity that were revealed in a staff conflict over the seemingly innocuous question, "Who will make the coffee?"

The episode took place on one of four wards on a training unit at the hospital. First-year residents were assigned to one of the wards for 6 months of work in long-term milieu and individual therapy with predominantly psychotic patients. Among the many kinds of therapeutic activities on the ward was a weekly community meeting of all patients and daytime staff, followed by a meeting of staff. The meeting was chaired by the ward leader. It was unstructured so that the group process inevitably led to discussion of some of the underlying conflicts existing among the patients and between the patients and staff. The staff meeting often uncovered feelings between segments of the staff that paralleled the feelings between the patients and staff.

The episode began with an incident that occurred among the patients during the beginning of the fourth month of the 6-month rotation. The patients' acute symptoms had subsided, and they were gradually increasing their involvement with the ward and with their psychotherapy. Conflict that arose on the ward focused on one patient, Miss X, a 22-year-old woman who had been hospitalized continuously for the previous 7 years with a diagnosis of chronic schizophrenia. During her stay on the training unit she had made remarkable progress. As one positive step, she had entered into business in collaboration with a man patient from another ward. Out of their own funds they had purchased a coffee urn and were buying Danish pastries in bulk every morning. With a borrowed medication cart carrying their wares, they went from ward to ward after breakfast each morning, and soon had a booming business selling coffee and pastries to patients and staff alike. The other patients became resentful of the endeavor and began scapegoating Miss X, who responded with increasing agitation.

A community meeting was held on the issue. The patients claimed that the staff were showing favoritism; they had understood that there was a ruling against private enterprise on the ward. However, staff supported appropriate personal initiative as a desirable quality and encouraged each patient to take suitable initiative as he felt ready. Miss X made an eloquent and effective speech in which she told of her long hospitalization

and the lack of interest, support, love, and financial assistance from her family. She described her feelings about her improvement and the feeling of warmth and closeness she had for the people on the ward. The other patients responded with apologies for giving her difficulties, and there was a reciprocation of warmth.

Miss X continued to be agitated. She turned paranoid attention to the staff who she felt were against her activity and thought ill of her. One week after Miss X's agitation began, a resident asked at morning rounds what had happened to the coffee that normally was prepared for staff, but had not been available all that week. Ordinarily the table was cleaned and the urn filled each morning by the aides who came in at 7:30, and the coffee was usually ready by 8:30 when rounds began. But simultaneously with the development of the coffee-pot issue among the patients, the table and urn had not been touched.

To the resident's question, one of the aides, most of whom were black women, replied, "You people leave too much of a mess for us to clean up after you. Besides, we're too busy in the mornings." The aides declared that if anyone wanted coffee, he should get it for himself; they were hired to be members of a therapeutic team, not somebody's maids.

The ward leader, a light-skinned black, then stated that the issue seemed to be whether or not the black aides would be servants to the white doctors. There was demonstrable physical stiffening by all concerned, and an uneasy silence. Then one aide said that she did not think race was a factor, but that some definition of respective roles was needed on the ward. She said that the aides were still not quite sure of what they were doing there, and it appeared to them that the doctors felt the aides' unique value was to take care of coffee pots.

The residents then countered that they did indeed feel it was part of the aides' role to make coffee for the doctors. It was the sort of thing done by nursing staff for doctors in all of the medical settings in which they had worked. They then asked the aides, "What do you do here anyway that you're too busy to make coffee for us?" The question enraged the aides, who enumerated their duties. The discussion ended at an impasse. However, Miss X's agitation subsided completely on that day.

Over the next few days the staff atmosphere was tense, and the issue was brought up almost immediately at the next staff meeting. One resident said he had done considerable soul-searching and he didn't think the racial issue was important. What was extremely important to him was his difficulty in finding his own role. He had given up his previous medical identity and was not yet comfortable in his psychiatric identity. He concluded that in view of those feelings it was not surprising that the doctors were attempting to maintain control by rigidly asserting traditional doctor-nurse roles. The other residents quickly agreed. The residents apologized for their defensive downgrading of the aides' role and expressed the desire to be closer by being less formal socially. As a beginning, they suggested addressing each other by first names.

The aides said that they did not realize doctors experienced such uncertainty about their own roles, and that they were sorry they had accused them of wanting to use them as maids when the situation was obviously far more complex. It was generally agreed that a person who preferred addressing a doctor formally should be addressed as Mr. or Mrs. by the doctor.

After this catharsis, the question of what to do about the coffee pot was raised again. The social worker suggested that, because making coffee and cleaning the pot were predominantly "women's work," the task should be rotated among all the women on the ward. The two women residents in the group responded with a resounding, "No!" For the remainder of the meeting there was an active argument between these two women and the rest of the staff. The meeting closed with the issue unsettled.

Another staff meeting was soon held in an attempt to resolve the conflict. Within a few minutes the struggle again became rough, with the men residents rigidly asserting that "biology is destiny." The other women had doubts about the basic femininity of the women residents. The latter reacted as if they were under siege, claiming that they were being scapegoated, and denying the significance of sexual differences within the context of the therapeutic community.

The ward leader concluded that the conflict could not be resolved by consensus, and, by virtue of his authority, declared that all the coffee drinkers on the ward would take turns making coffee. All staff members seemed glad to have been relieved of the responsibility for deciding the issue, and the episode was ended.

Additional information on the various issues involved in the conflict was obtained through retrospective discussion with the participants.

The identity crisis of the first-year residents—Recently careful attention has been paid to the vicissitudes of the process of becoming a psychiatrist. A personal and professional disruption may well be considered normal, and it paves the way both for personal growth and for acquiring the critical psychiatric skill of observing oneself at the same time as observing others. In this episode, the residents were still experiencing that crisis, and their words graphically depicted their torments.

Class and status—First-year residents are preoccupied with learning about their patients and controlling their own anxiety. They are usually politically and socially liberal, but in many cases have not had the opportunity to empathize with people from backgrounds totally different from their own. Therefore to learn of the newly awakened aspirations of the aides and their consequent feelings of betrayal (expressed through the symbol of the coffee pot) was a valuable revelation for the residents. By the same token, because the residents sincerely apologized and spoke openly about their own problems as they perceived them, the aides were able to see them as human beings with feelings similar to their own.

The reluctance of several aides to call the residents by their first names is notable. The aides requested equality, but several clearly felt unprepared for the degree of familiarity that first names implied. They experienced anxiety because of an unconscious fear that with further closeness they would be found inadequate.

Race—The black-white issue was clearly an important part of the conflict. The group's resistance to discussing it led the ward leader to assume that the issue was "too hot to handle," and thus he didn't push it. Although the ward leader was black, he was so light-skinned that he might readily be taken for white. The residents feared that on the racial aspects of the coffee-pot issue he might side with the other blacks and turn upon his fellow residents. The black staff feared that the ward leader would turn against them, siding with those

who were light-skinned and were physicians like himself.

Sexual roles—The conflict that emerged over sexual roles had different determinants in each group of participants. Had the suggestion not been made that the women alone take turns making the coffee, it is likely that the men residents would have participated without any objection. However, after having barely recovered from the anxiety of the conflict over status and role, they were eminently vulnerable to being called "boys" by the woman resident. For them it became a question of whether they would also be deprived of their manhood.

The feelings of one of the women residents complemented those of the men. She was sensitive to being deprived of professional status by being isolated from her peer group with a number of women who were not psychiatrists. That became an intolerable affront to her struggle for equality with men. The aides' attack on the women residents was partly based on resentment of the two women, who had the prerogatives of high status in the world of men. Additionally, they perceived the women residents' refusal to participate with them in "women's work" as a denigration of their basic worth and a further reflection of a racially superior attitude.

An extra dimension was added by the major differences between this episode and the typical Stanton-Schwartz phenomenon. First, the episode began with a real conflict between Miss X and the other patients. Second, as Miss X's excitement increased, it coincided with disagreement among factions of the entire staff. Third, the staff conflict related to the symbolic meaning of the activity in which she was engaged, rather than to disagreement about her management. Fourth, multiple issues of covert staff conflict were expressed through a single symbol, just as a single phobic or hysterical symptom may be representative of multiple levels of conflict in an individual patient. And fifth, Miss X's excitement subsided completely and immediately as soon as the staff conflicts were uncovered, rather than subsiding gradually as the conflicts began to be resolved.

Many questions are suggested by the patients' part in the episode. If there had been no coffee pot among patients, would there have been a coffee-pot incident among staff as the symbol through which to deal with their own multiple conflicts? There remains the enigma of how covert staff conflict is communicated to a patient. There may be subtle cues to which the schizophrenic patient is sensitive, but the exact mechanisms in relation to the Stanton-Schwartz phenomenon remain to be elucidated.

Condensed from *Hospital and Community Psychiatry*, 23(2), 33-38, 1972.
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Reprints of original article from Walter H. Bradshaw, Jr., M.D., Assistant Professor of Psychiatry, Howard University College of Medicine, Washington, D.C. 20001

Applied Behavioral Science in Urban Administrative/Political Systems

William B. Eddy and Robert J. Saunders

It is legitimate, if not novel, to assert that local government institutions must find ways to increase their effectiveness if they are to solve the problems of this urban society. One aspect of government that needs improving is the administrative system. A variety of avenues to upgrading administration are being proposed and tested.

Each critic of local government generates his own description of what is wrong—depending upon his own orientation and the perspective from which he views the community. From the point of view of applied behavioral science the problem looks like this: Most governmental organizations were built upon the traditional bureaucratic model. This form is characterized by an emphasis on efficiency and rationality, a pyramidal authority system, functional units clearly separated on the basis of mission, and a system of rules and procedures to direct and control the behavior of employees. This system is a rational design for the accomplishment of order, reliability, accountability, and precision as basic outcomes. But the bureaucracy has distinct disadvantages in attempting to deal with the dynamic and complex urban scene. Some of the organizational problem areas that require attention include: Increased flexibility and adaptation to change; a shift from emphasis on control, structure, and compliance to a focus on problem identification, problem solving, and innovation; more effective teamwork and collaboration within and among operating units; development of managerial approaches which utilize the full potential of employees and enhance motivation and commitment; development of more "open" organizational systems which are in touch with and responsive to external as well as internal factors.

One approach to the resolution of these kinds of problems has been to leave the basic model of the organization intact, but to beef it up by increasing the rationality through the use of control systems, structural redesign, and more qualified professional experts. An alternate is the use of "applied behavioral science," which includes such approaches as planned change, organization renewal, organization development (OD), and grid organization development. The purpose of this article is to identify and address some issues related to the "fit" between the behavioral science change model and urban agencies where the political/administrative mix may pose problems different from those encountered in private business.

Many applied behavioral scientists take a position about appropriateness or inappropriateness of certain kinds of organizational behavior based on values, insights, and empirical evidence. The following are illustrative:

- *Openness and authenticity.* Communication about perceptions, ideas, and feelings should be free and open in all directions.
- *Trust.* A necessary component of effective collaborative relations is a level of mutual trust which will support openness, acceptance of others' positions, risk taking, and mutual support.
- *Shared influence and participa-*

tion. Organizations may function more effectively if employees at all levels are allowed a sense of ownership through opportunities to influence decisions and plans that affect them.

- *Development of people.* The organization has a need and a responsibility to help its members continue to develop themselves as fuller, more competent, and actualizing total persons.
- *Confrontation.* Traditional norms stressing avoidance of direct confrontation are dysfunctional. Avoiding conflict may prevent problem solving.
- *Interpersonal competence.* Organizational members need to gain greater self-understanding and operational skills in such areas as communication, teamwork, and conflict management.
- *Change and renewal.* Organizations should devote time and resources to the development of mechanisms that assure a continuing review and renewal process.

Application of Behavioral Science in Government

Organization development programs utilizing applied behavioral science have been tried extensively in business firms. There is less direct experience in public agencies. The major differentiating characteristics of government are: multiple access—the system is more open to influence at many levels; greater variety of interests, reward structures, and values at subgroup levels; more competing command loci or influence centers rather than a clear-cut "management group;" and weak linkages between political and career levels, which may mean between executives and operating managers.

There are also the unique patterns within the institutional environment of public agencies which may inhibit the process of change. Phenomena include reluctance to delegate because of the need to maximize information and control at the top; legal specification of appropriate work behaviors; greater emphasis on security; stress on procedural regularity and caution; and a less strongly developed concept of professional management.

Possible reasons for the current minimal utilization of behavioral science in government are: Alternative change programs are more consonant with the legal-rational bureaucratic approach and may be perceived as less threatening to the status quo; some political scientists and public administrators are "natural enemies" of behavioral science; behavioral science is often seen as "tenderminded" with an undue focus on keeping employees happy; participative approaches are suspected as coverups for management by committee or turning the organization over to the subordinates; and the values underlying applied behavioral science may be in conflict with values inherent in some agencies.

Political Issues Related to Behavioral Science in Local Government

Our experiences in carrying out organization development programs in local government agencies have made us aware of other potential problem areas that need attention and understanding.

There are the usual problems of interfacing any administrative system and political system: mutual mistrust between the public and the bureaucrats, politicians vs. administrators in policy formation, concerns about keeping the technocrats publicly accountable, generalized resistance to change, and political pressures in relation to specific programs.

There is a potential incompatibility between political systems and the "ideal" organization from a behavioral science point of view. Political systems are by nature *distributive*. They function to divide a finite amount of resources among various interest groups. This is a win/lose game in which a variety of tactics are used to increase the rewards to one group—which often means they are decreased to others. The well-functioning administrative system aims at being integrative. Emphasis is placed on communality of purpose, collaboration, and win/win relationships. A highly integrative organization at the local government level may not serve the felt needs of politicians whose own goals require special output from a particular segment within the organization.

Trust and openness may not be possible in situations with political implications. An official in NASA is quoted as saying, ". . . we never punish error. We only punish *concealment* of error." This policy is intended to reinforce openness and disclosure. Many local government officials may feel they cannot afford this much risk, and may be more concerned about concealing errors than whether or not errors were made in the first place.

Some of the techniques of the application of behavioral science involve recognizing and dealing with the feelings, attitudes, and personal styles of participants. There is considerable misunderstanding and suspicion regarding approaches such as sensitivity training and team building which are designed to promote communication and learning about interpersonal relationships.

Conventional wisdom views "good" leadership, assertive-authoritarian leadership, and masculinity as essentially synonymous. Approaches to leadership which assert that subordinates should have upward influence, that dissident points of view should be listened to, and that solving problems is preferable to discipline are seen as weak and ineffectual.

Organization development proposes that work time is legitimately spent working on relationship issues. Terms such as "team building," "working the problem," and "processing" refer to situations in which administrators do not do *work* in the traditional sense, but meet to talk about how they might work more effectively together. Politicians and the public may feel that this is wasted time. The fact that human systems require *maintenance* in much the same way that machines do is not widely understood, and training which is not technical training is not valued.

Special problems may be caused by a press which maintains a traditional view of organizations and of local government. There is pressure for all "official" meetings to be open, and everything to be on the record. This condition reinforces closed, safe discussions and discourages sound problem solving in groups. Members of the press need to gain insights which allow them to differentiate between "dealing with policy" and "dealing with each other" meetings.

Laws and policies relating to accountability grow out of assumptions that people in general are not be trusted, they are not responsible, and they must be closely watched. Applied behavioral science tends to assume different motives—most people want to work, to develop, to assume responsibility and contribute to the system. Shared decisionmaking, less rigid controls, decentralization, and delegation are seen as improving, not damaging, the organization.

There are strong tendencies to

value local government structures which provide for strong authority figures, centralization, control, and accountability as defenses against potential spoilers. In essence, it may be perceived better to run a highly controlled system whose members care less and accomplish less individually and collectively, but which runs less risk of scandal.

The hard sciences have managed to gain the trust of many people. The "soft" sciences of human behavior have not reached that point. They have no easily visible "better things for better living" or men on the moon to win friends. Further, the application of the medical model to the analysis of behavior has tended to associate psychology with the sick and the flawed—not a positive association in political terms.

Overcoming Resistance

Although it is risky to propose solutions before the problems are clearly defined, several possibilities for coming to grips with some of these difficulties can be offered.

- We have been involved in several efforts to utilize organization development in the interface between administrators and politicians. Experience indicates that such efforts are feasible and worthwhile—but one must proceed carefully. There is a need for clear prior acceptance by all parties of the relevance and validity of the problems to be attacked and a commitment to facing and solving them. It is important to clarify norms that can allow trust to develop—for example, that conversations be kept confidential within the training group, that participants view feedback as an attempt to be helpful and not to be resented later, and that major conflicts and disagreements be acknowledged and worked through.
- Behavioral scientists and administrators know much more about overcoming resistance to change than they tend to utilize in implementing their own change programs. For example, the greater the degree to which those involved are informed, allowed to contribute to the effort, and feel able to exert influence on the process, the less likely they are to resist or sabotage the effort. Other strategies for preventing resistance include building a climate of trust between the client and the change agent, not violating important organizational norms, and beginning the change with problems that the client feels are most important.
- Organizational change efforts may need to be preceded by thorough informational and educational programs conducted both within and outside the organization.
- The behavioral scientist who would bring about change in municipal affairs must build a power backing. He may do this by direct political activity in support of sympathetic candidates, relating to strong community action organizations, or personal cultivation or reaching out to men in power to gain understanding and personal acceptance.

Condensed from the *Public Administration Review*, 32(1):11-16, 1972.
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Adverse Reactions to Phenelzine: Results of a Nine-Hospital Depression Study

Allen Raskin

Since several monoamine oxidase inhibitors were removed from general prescription use in this country because of toxic reactions, clinicians have been reluctant to use any of them in the treatment of the depressive illnesses. The incidence of hypertensive crises, the most serious side effects of MAO inhibitors, dropped sharply following the discovery that tyramine appears to be a pressor substance whose effects on blood pressure in man are potentiated by amine oxidase inhibitors.

Phenelzine, one of the MAO inhibitors still available for prescription use, is reported to be less potent and slower acting than tranylcypromine; it is also reported to be less potent and slower acting than tranylcypromine; it is also reported to be safer, i.e., less likely to produce a severe hypertensive crisis.

The Nine-Hospital Collaborative Study

The Psychopharmacology Research Branch of the National Institute of Mental Health coordinated a nine-hospital study of the differential effects of phenelzine, diazepam, and a placebo on newly admitted, depressed patients. This was a double-blind study, and 110 of the 326 study patients received phenelzine (38 males and 72 females). For admission to the study a patient had to be between 16 and 60 years of age and with no evidence of liver damage; the median age was 37 years.

The study ran for 7 weeks, but the active medication phase lasted only 5 weeks. Patients were started on 22.5 mg. of phenelzine. This dosage was increased by 7.5 mg. a day to a total of 45 mg. a day from the 4th through the 28th day in the study. Medication was gradually reduced during the 5th week, and patients were off medication entirely during their last 2 weeks in the study. In an effort to minimize drowsiness and side effects during the day, the medication schedule called for two-thirds of the daily medication to be administered in the morning. All study patients were placed on special diets which eliminated foods with a high tyramine content.

Side effect terminations—Only three (2.7 percent) of the 110 patients started on phenelzine had to be terminated for serious side effects. One patient was terminated after 26 days for severe headaches which persisted after the medication was discontinued. Another was terminated after 8 days for persistent complaints of dizziness, faintness, and a skin rash.

Finally, and most significantly, a 38-year-old woman developed the following symptoms after 1 week on medication: an exfoliative dermatitis which subsided toward the end of the third week in the study; swelling of the right lower extremity; burning pain in the abdomen, and liver enlargement which was palpable and tender. The patient was terminated from the study at 22 days. One week following the discontinuation of medication, there was a disappearance of all signs and symptoms, except that the liver was still palpable but nontender.

Frequency of drug-related reactions—Prior to the start of medication and at weekly intervals thereafter, prescribing physicians interviewed pa-

tients and completed a 47-item symptom or side effect checklist. Each item on this scale was rated on a four-point scale (absent, mild, moderate, severe). Symptoms characterizing the depressive illness itself were included on the side effect checklist because of some reports of tranquilizers exacerbating the symptoms of depression. Agitation or excitement was included as there also were reports of antidepressants activating a psychotic process or causing agitation.

There were only eight symptoms on which 5 percent or more of phenelzine patients received moderate or severe ratings at 3 weeks. These were depression, initial insomnia, late insomnia, agitation or excitement, loss of appetite, dryness of mouth or throat, constipation, and headache. Moreover, moderate or severe ratings on these symptoms occurred more frequently at the pretreatment period than at the end of 3 weeks on phenelzine. This finding is not surprising, as all of these symptoms have been reported as manifestations of depression. There was a striking similarity in pretreatment to 3-week frequencies for the placebo and phenelzine patients, also attesting to the low incidence of distressing side effects associated with phenelzine.

The results of the collaborative study support recent literature on adverse reactions to phenelzine. When dietary restrictions are imposed and foods with a high tyramine content are eliminated from their diet, few patients develop acute hypertensive crises. None of the patients had to be dropped from the study for this reason. There does appear to be some validity in not administering phenelzine to patients with known liver damage. One patient with no prior history of liver disease developed liver enlargement on phenelzine which necessitated her removal from the study. Other less serious adverse reactions to phenelzine noted in the literature, such as dry mouth, sweating, constipation, headache, and drowsiness, occurred relatively infrequently, and most of these symptoms were present in greater extent and magnitude at the pretreatment period than after 3 weeks of treatment with phenelzine.

In a study in which hospitalized patients were placed on low-tyramine-content diets, there were few serious phenelzine side effects, and none of the 110 phenelzine patients had to be terminated for a hypertensive crisis.

Condensed from the *Journal of Clinical Pharmacology*, 12(1):22-25, 1972.
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A Social Psychological Study of Attitude Change in Physicians

Adina M. Reinhardt and Robert M. Gray

Research on a subject that relates to the development of physicians' attitudes toward their patients has revealed that medical students' attitudes of cynicism increase and their attitudes of idealism and humanitarianism decrease during medical school training. The results of one study indicate that a large proportion of these new doctors, after being in practice, show little or no reduction in their levels of cynicism. The research reported here is an investigation of the influence of situational factors on medical students' attitudes of cynicism and on what happens to these attitudes after the students leave medical school and enter practice.

Psychiatry was selected as the focus of the analysis since it is the medical specialty most dependent upon positive mutual response between physician and patient and since, of the medical specialists examined in this study, psychiatrists place by far the greatest emphasis on the socio-emotional qualities of the patient.

Medical specialties other than psychiatry were divided into two groups according to whether they require more or less dynamic involvement on the socio-emotional level between physician and patient. Medical students intending to enter psychiatry were compared with their counterparts planning to go into low or other high interaction specialties. A similar comparison was made between those individuals who actually entered psychiatry and those who entered low or other high interaction specialties.

Since a moderate amount of cynicism is functionally useful in aiding a student to progress successfully through medical school, it was expected that almost all of the students would adopt these attitudes while in the role of the medical student. Consequently, the first hypothesis formulated was as follows: Medical students who select psychiatry as their future specialty will not differ in attitudes of cynicism at the time of their graduation from comparable students who select low interaction specialties or other high interaction specialties. The second hypothesis, which follows, dealt with the prospect of a change in such attitudes after graduation: After entering specialty practice, psychiatrists will have lower cynical attitudes than will physicians in other high interaction specialties as well as doctors in low interaction specialties.

The Investigation

The sample consisted of 63 of 96 physicians who graduated from two classes of a western State university. When the followup study was made, 15 physicians were general practitioners; the other 48 physicians were distributed among the specialties as follows: 11 psychiatrists, 6 internists, 6 obstetricians-gynecologists, 3 pediatricians, 9 surgeons, 2 anesthesiologists, 2 radiologists, 2 pathologists, 3 public health specialists, 3 neurologists, and 1 specialist in rehabilitation medicine.

Attitudes of cynicism were measured by a cynicism scale which offers seven alternatives to indicate the strength of the study subject's agreement or disagreement with such statements as: "The law is often the refuge of slick operators." "Most people make friends because friends are likely to be useful to them." "If you don't

look out for yourself, nobody else will." The cynicism scale provides a measurement of cynicism which is defined as behavior characterized by the "conviction that human conduct is directed by self-interest or self-indulgence." Furthermore, cynicism tends to be typified by detachment and toughness in interpersonal relations.

The study subjects were divided into three groups on the basis of their choice of specialty at the time of their graduation from medical school: students who intended specializing in psychiatry, other high interaction specialties, or low interaction specialties. These three groups were administered the cynicism scale; the groups were then compared to determine whether they differed in the proportion of subjects with high or low cynical attitudes. Four years later, after they had completed their residency training and entered practice, subjects who at that time were placed in one of the three groups according to the specialty they were practicing were again given the cynicism scale and the groups were compared.

Data Analysis and Implications

There were no significant differences in cynical attitudes between medical students planning to specialize in psychiatry and those students intending to enter other high patient-physician interaction specialties or low interaction specialties. These data support the hypothesis that the three groups of medical students would not differ in cynical attitudes at the time of their graduation from medical school.

There was a noticeable downward shift in the number of subjects with high cynical attitudes after leaving medical school and entering practice, with the greatest change taking place among the psychiatrists and the other high interaction specialists. These data disclose that all of the psychiatrists, slightly over two-thirds of the physicians in high interaction specialties, and less than half of the doctors in low interaction specialties had low levels of cynicism as determined by the same technique that was used in assessing their attitudes at the time of their graduation from medical school.

This analysis supports a conceptual framework which explains cynical attitudes among medical students and their modification later when their training is completed and they are in practice as being in part situational responses rather than stable traits possessed by individual doctors. Apparently attitudes of cynicism are developed by medical students and retained by some physicians after they enter practice because they are functionally useful. They appear not to be functionally useful to psychiatrists and a sizable proportion of other high interaction specialists.

The importance of further endeavors and research in this area is clear once it is recognized that a good doctor-patient relationship is central to satisfactory medical practice from the standpoint of both the physician and the patient.

Condensed from the *Journal of Medical Education*, 47(2): 112-117, 1972.
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Bruner on Research and Society

Dr. Jerome S. Bruner is Director of the Center for Cognitive Studies at Harvard University. Beginning in the Fall of 1972, he will hold the Hugh Watts Professorship of Psychology at Oxford University, England.

Q: *Could you tell the* Mental Health Digest, *Dr. Bruner, what your philosophy of research has been?*

A: What is research life all about? Partially you're doing it because you can't help but do it. You're intrigued in the same way that painters paint and teachers teach. You do it partly for the extrinsic work and partly because you have something in the back of your mind. If anybody says why did you choose to go into psychology, the answer is a complicated one because no one really quite knows reasons why. At an impersonal level, this seems to be a period in which man studies man. At another level, we sometimes come into contact at an impressionable age with superb models of people. My first professor of psychology, at Duke University, was a model who struck me as a man of enormous integrity. As for my early interest in perception, perhaps it stemmed in some way from the fact that I was born blind and very early in life had my sight restored. But I wonder whether these are the real things that tell one much. More interesting is why one continued in a certain direction, what the style of the research is.

Q: *Why did you continue along the lines you chose?*

A: What I have been trying to do in my research is to find out what is distinctly human about human beings, about the characteristics of man as a species.

Man's capacity for operating at his fullest level—that was the question behind our setting up the Center for Cognitive Studies at Harvard. I worked with rats, I worked with infants, and I will be working again with animals. But if you really want to understand man you have to understand him at his fullest evolutionary advance, as an organism capable of extraordinary powers—speaking, thinking, reasoning, using tools, developing social systems and cultures. These are the things the psychologist eventually has to answer and in a way it has been answered for other species.

But he doesn't reduce man to a set of pigeon-peckings as was the very fashionable 19th Century approach. What he does instead is to take man where he finds him, and tries to explain behavior with all of its complexity. We do not want to be like the man who loses a half-crown out in the middle of a road, but looks for it along the edge of the roadway because that's where the light is. Some psychologists think the light is where simple reflex actions hold. I don't believe it.

Q: *Could you illustrate from your more complex view of behavior?*

A: First, let me give you an example of a colleague whose work I respect very much. The power of Chomsky's approach to linguistics is his view that to explain linguistics you've got to take a look at man's language behavior, and explain not what you think language to be, but in fact what it is.

That's what I've tried to do in my own work, first on problems of perception. We tried to find out the way in which human interests, motives, and sets make perception a highly selective operation, and not a neutral

system with respect to information pick-up. Our effort was to get at the characteristics of man in his characteristic setting.

Q: *And your studies led you to other facets of our thinking process?*

A: Yes. After working for nearly a decade on problems of perception, it was clear to me that the real problem is the extent to which man has a capacity for taking a minimal input from the environment and converting it by inference into a percept. He says, as it were, from those particular clues, I infer the presence of the following object. Under these circumstances perception has a way of digging you in and in, so that you expect certain things of objects. As you expect certain supporting cues, your threshold for seeing the supporting clues increases.

Then, partly because of a very interesting and happy year at the Institute for Advanced Studies at Princeton, I decided to look at the process of inference. The work was later re-

ported in 1956, in a book with Goodnow and Austin called *A Study of Thinking.*

Q: *What were you able to conclude in this approach to man's rationality?*

A: We were absorbed in trying to recapture man's strategies for utilizing minimal information. The various forms of our rationality, interestingly enough, are not just machine-like, with given forms of speed for processing information. It's what man picks up, and his proneness toward certain types of error. His easy inferential capacity gives him speed, and leads him to ride along the lines of highest correlation within his environment. At the same time, this capacity also digs him into errors of expectancy, errors that might be said to reflect his own banalities. In fact, he begins to see the things he expects if he is in a low-grade situation.

Q: *How then did your work on strategies of thinking lead into developmental studies?*

A: I was concerned with how it is that human beings develop and achieve these strategies of thinking, and found myself getting more and more involved with developmental studies. A researcher's interests vary, I think, depending upon what kind of research he has completed, and where he is in his career. But, it also tends to reflect personal things. My children were then of school age in the process of growing up. What struck me was that their development of strategies wasn't linear. Children don't simply get exposed to events in their environment, or learn how to deal with them in certain ways by virtue of reinforcement. Rather, they seem to move forward by leaps. They develop forms of strategies that reflect in a kind of general approach.

I started off on a series of studies that had to do essentially with the efficient ways children process information. It was then that it really came to me in a heap, the way human beings develop. Totally, in terms of spontaneous theory of development.

Q: *And your interest in education?*

A: Basically, any theory of development has inherent within it a theory of education. No people ever permitted their children to grow up without changing the conditions of the environment, arranging certain things for children to do and rewarding them.

I found myself interested not just in development, but also in those things that are called aids to development, that are prescriptive and not solely descriptive of nature. When I chaired a National Academy of Sciences Committee on Science Education, I went back and sat in on some school classes. It was an eye-opener. The learning environment of school, I discovered, wasn't reflecting our aspirations.

Q: *Was that what led to your book,* The Process of Education, *in* 1960?

A: Yes. As interested as I was in intellectual development, I decided to have a look at the way in which children learn in school settings. It was a period of new curriculum development in America. My colleague, Jerrold Zacharias, and my close friend Francis Friedman were then setting up a physical sciences study committee. And they began to ask us questions. If you want a child to learn physics, for example, what would you do? How would you do it? So we started to look at the learning of physics. It was fascinating. We discovered that a child learning physics is like a physicist learning physics. Insofar as he has to learn a middle language

about physics, rather than about physics itself, it gets in his way. He needs information for hypotheses and testing. We organized a meeting at Woods Hole for people concerned with these matters. Out of that came *The Process of Education.* The book has had an extraordinary history, including translation into 24 languages. The interest in it suggested to me the extent to which we were now ready at last to take a look at a child's real capacities.

Q: *Had you been in touch with Piaget, who was already contributing his theories on the development of children?*

A: I was in touch with Piaget a good deal during that period, and we grew to be close friends. He has been very important to me in my intellectual life.

Whenever you take it upon yourself to teach well, to give embodiment to ideas, to make it possible for a child to start off at an intuitive level and then proceed to understand something by going more and more deeply into it, you're struck by the fact that children are capable of learning far more than you ever dreamed.

One person after another in the curriculum study pointed out how well children can learn under optimal circumstances. Indeed, one of our major conclusions was that any subject can be taught to any child at any age in some form that is honest.

Q: *Doesn't this contradict Piaget who held that how and what a child learns is specific to his stage of development?*

A: On the surface, this may appear to contradict Piaget's very bold assertions. But it isn't really inconsistent because what we're saying about knowledge, generally, is that it can be converted into a form that fits a student's age. As he grows he can then convert it into a newer and deeper form.

It isn't so much that we care about teaching children early, but that we care about teaching them deeply, giving them an opportunity to understand, and to elaborate upon their knowledge as they develop.

Q: *One of the things that impressed you most when you turned to the world of the classroom was the intellectual capacity of the very young child?*

A: Yes, we had gone on to produce a curriculum for 5th graders called *Man, A Course of Study,* and the whole school experience reinforced what we were learning in our research. We were struck by what an enormously competent character a 3- to 7-year-old child is.

I felt that somehow we must look a bit earlier still into human behavior, into the preschool origins of intellectual development. For the last several years now we have been studying early infancy in great detail. We are finding that right from the start organisms understand keenly the relationship between their act and its consequences. The infant's basic unit of knowledge is his own act and its consequence. Infants are quite capable of learning when you link the two.

Q: *What is the connection between recording the most minute detail of an infant's movements, and the manner in which our schools teach?*

A: Now we're returning to the question of how one proceeds. Obviously, I have been involved in trying to reform our education, to help it develop and foster the highest potential of our young. Yet my most real activity, so to speak, is carrying out the necessary research.

Why have I chosen the research end of the picture? Why, for example, have I just spent the last 3 weeks reading everything I can on the evolution of the uses of immaturity—the evolution of immaturity generally in Old World monkeys and in chimpanzees? Why do I think this is important?

I have to answer honestly that I don't think research is an end in itself, as far as society is concerned. It's a pleasure in itself. I enjoy it. If there were no problems at all in the world I would still want to do this. This is my thing. But that isn't the point of the research—to give me satisfaction, however nice that may be.

In view of the fact that man is an organism who depends upon culture, and who makes his own environment, it becomes necessary for us to understand man's capabilities, what he has evolved from, what the process of maturing is like, and what our constraints are. How close can man approach full, efficient, effective rationality, and what are the barriers to rationality? The person who does research on man must pose questions about man's perfectability, and the opportunities—and limitations—inherent in man.

Q: *How is knowledge like this used by society in general, or isn't that the scientist's concern?*

A: The scientist's job is to tell you what's possible. It is society in general which has to argue about what's desirable among the various possibilities. This is not something the scientist can do. But a scientist who understands man can give you ideas of possibility. He is concerned not merely with what is, but with what could be, given certain conditions.

In my own case, my interest in the nature of human perception, inference, and strategies of thinking led me to consider what kinds of environments are necessary for human beings to realize their potential. This has philosophical implications and, indeed, political implications as well. For example, it's clear by now that growing up in the discouraging situation of poverty and racial barriers leads to hopelessness. When it doesn't seem worthwhile to solve problems, you give up. This becomes not merely a scientific issue, but also a moral one.

Q: *Aren't you now broaching the topic of the scientist's role as citizen?*

A: There is a moral and philosophical side to science which is terribly important. A decade ago we may have been embarrassed about this, but today it would take a great optimist to say that the human race is going to go on and on. To watch the pollution of the environment, for example, to watch the extent to which we are capable of setting man against man, forces you into making moral choices.

For example, it is not factual to say that there is no problem in America in raising children when we know that over 4 million mothers with young children are in the labor market. If society is to be concerned with the care of children, and the full development of the child, the scientists can give some indication of what it takes to reach these aims. But we're still embarrassed about this role of the scientist, really.

Q: *Perhaps you would feel just as involved no matter what your profession?*

A: Perhaps. I'm also a child of my times. My earliest political memory is of refugees coming to this country from Nazi Germany, including scientists whose free inquiry was inconsistent with Hitler's shibboleths about man and nature. I feel very much engaged and I always have.

Q: *Then you don't thinks it is necessarily an either-or proposition for the scientist?*

A: Definitely not. I am grabbed by basic research, but I am also concerned with the implications of the research on man. Like a great many scientists I've been grabbed by both. Leave your basic research alone. It will take care of itself, don't try to censor it.

Q: *Could you give us an example of some basic studies which turned out to have practical implications?*

A: I was vastly concerned at one point with the extent to which and the conditions under which rats learned a wide strip of their environment as compared to learning narrowly. At the time what interested me about evolution was the extent to which organisms are capable of picking up information beyond the immediate requirements of a given task, as compared to picking up only task-relevant cues.

Well, 15 years later it turned out that these studies led to some of my most important thinking about the nature of education. I hadn't done the research because I was interested in education, I did it because I was interested in how information is processed by organisms.

Q: *Are you implying, then, that it would be constrictive if all research became mission-oriented?*

A: When somebody tells me that to contribute to the well-being of man we must do mission-oriented research, and that they'll tell me what the mission is, my reaction is to raise an eyebrow and say, "How do you know what tomorrow's mission is going to be? How do we know what mission leads to what?"

The things we do know for sure are what our work tells us. We know, for example, that knowledge is hierarchically organized, that there are some general things from which specific things are induced. To tell me not to have been concerned about breadth of learning in the rat would have been a mistake. Of course, none of us knows whether what we do really is going to make all that much difference to the human race. But suppose it turned out to be the case that some of the notions we have about the nature of learning, of drive conditions, of overload of information and practice, and other observations from our studies on perception and attention—if these have affected the way we look at the nature of education, then it will have turned out to be very useful indeed.

So while I understand fully how a government in these times would want somehow to make research have maximum relevance to the grievous problems of our times, I can't believe that the best way to do it is for somebody at some central point to decide what are the missions to be carried out by scientists and to lend support there. I think this leads to shallow research, but even more importantly, I fear, to a shallow education of the young.

Q: *So you believe that a researcher—despite the times in which he lives—can make his best contribution by going where his curiosity and intuition lead him?*

A: Precisely, and I should like to illustrate. I've been lucky to have some very distinguished students at the Center, and they are able to pursue their studies in a totally free and unembarrassed way. When we're trying to understand how the child first uses his hand to take an object under visual control, for example, and how this skill differs from that in a rat or prosimian, we've got to understand

that, because that's where our interest in human intellectual development has led. You've got to go where you are led. You can't say, well, I'm getting a little bit cold now, I'm losing the track, I better turn to problems of race, poverty, war, or ecology.

There is great wisdom in the French proverb that you sometimes have to draw back to leap again more strongly. We must not become too swept away by the ideas that we can plan each step. There has to be some trust for the left hand, as it were, the intuition. It can't all be done by the right hand.

Now, having said that much, I do want to tell you one of my peccadillos. I've always tried to give my advanced students—at least in the last 10 or 15 years—a sense of the skills involved in relating knowledge to action and policy.

We scientists usually assume that it takes enormous research to establish a fact, and enormous methodological tact even to design an experiment, but that somehow being President, or Congressman, or delivering medical care at the local level is easy. It's not easy. It's just as difficult, it takes just as much skill, and it requires a degree of alliance and passion for the problems of application on both sides.

While a moment ago I said I am appalled as a scientist at the thought of someone directing what our research missions should be, I now take the other side and say it's just as bad for the scientist to denigrate the policy maker and the skills involved.

What I'm suggesting is that as we move toward a world in which we're all face-to-face with grievous problems, we must define ourselves more and more as whole men or women. This may make the scientist more vulnerable because someone will raise the question of his objectivity. But, I don't think that is a serious problem, really, if one faces it honestly.

Q: *Could you elaborate?*

A: If I do my research openly, honestly, tell how I did it, give a sense of what it's about, it becomes part of a marketplace of ideas in which people challenge and make their counter claims. The assumption that there is a particular way to study behavior, a particular set of concepts that you must use to assure your scientific kosherness is part of a funny game our scientists and psychologists in particular like to play. What I think of as objectivity is letting the marketplace—an open market—determine the value of ideas by test and retest. Now, that's objectivity.

There is also an open market in the moral sphere. For example, I might say fellow citizens, if you want independent-thinking children, you've got to stop running schools in which children just give back what the teacher says; that does not promote independence. If children are going to think independently, they must be given an opportunity from the start to think on their own.

If you want a child to develop into the ways you want things done you can get that kind of child, but don't say you weren't warned. In this case, I am doing what a scientist must also do, that is, point out the consequences of certain acts. Being a scientist doesn't make me a high priest. But it does enable me, perhaps, to see and suggest options.

Now you may say research for itself is not as interesting as research that bears on man's eventual fate. But these two, it seems to me, when you deal with the human sciences are inextricable. It is extraordinarily diffi-

cult for the developmental sciences ever to be neutral.

After having said all this I want to ask one thing of you. I want to ask you never to say to me, wherever you should meet me, "Why are you doing that particular thing?" One of the things I'm going to be doing is to start some studies on the nature of tool use and instrumental behavior. I mean to study it in rats, chimpanzees, in prosimians, and in human children. I don't know for sure where it's going to lead me. But again, I must be given the privilege of my left hand, my intuition. I believe there's something intrinsic about human intellect that relates to man as a tool user. My impulse is that it's important to study this and contrast man with other species. It might even have some bearing on how man gets on. That's all I can possibly promise. But isn't that enough?

Q: *One aspect we haven't yet touched upon is the synthesis of knowledge from many disciplines.*

A: To me it's a most intriguing pursuit, to see how the pieces all fit together. To understand man's characteristics as a speaker, a tool user, a user of culture—you must have a sense of a wide range of things. You must understand something about linguistics, anthropology, sociology, evolution, experimental techniques, etc. Psychology has carved out for itself a very complicated field of endeavor.

Q: *Your capacity for synthesis, your perspective in these matters is nonetheless very impressive.*

A: Partly, it is a function of where you are in life. A very dear friend of mine—a former student of great intelligence—once said to me, as I remember years back, "How can you, given the nature of the world, spend time studying the perception of slanted lines, really?" At that time, I was very much interested in the question as to whether there is some natural orientation upright and down that would give some structure to visual space. It's difficult to say where that bit of information fits into the scheme of things. But there does come a point where one constantly recycles it, taking that piece and a host of others to build an understanding of the nature of the visual system and the way in which it reflects something about the nature of the world and at the same time is capable of having hypotheses about things that aren't there.

And then I ask myself the evolutionary question about how did it get to be this way in terms of selection pressures, and I become interested, too, in how philosophers have looked at the question. And then I turn right around and recycle the information. It's like a spiral that keeps ascending.

The next thing, I found myself—as I did 3 years ago—doing comparative studies with high-speed photography of the way a child reaches—the child's hand reaching—and the reaching of *Loris*, a prosimian from Indonesia, who is a very early primate.

You go broad and then you have to go narrow to test your hypothesis. To do both is in the nature of science.

I would like to see us get back to a sense of movement toward understanding at a deeper level and away from the idea that the only understanding worth having is the understanding that can do something for you immediately, today or tomorrow. I think we will increase the likelihood of being here much further into the future if we go steadily about the business of extending our knowledge of man's development, capacities, and unique behavior.

mental health news digests

News from the World Federation for Mental Health

The Federation will hold a meeting and workshop on the topic of "Culturally and Linguistically Handicapped Children" in Tucson, Arizona, November 13, 14, and 15, 1972. Further information may be obtained by writing John C. Duffy, M.D., 1415 North Fremont Avenue, Tucson, Arizona 85719.

The Federation recently issued the following Freedom of Conscience statement: "There are many definitions of mental health but one thing they all have in common is the recognition of each man's freedom of opinion which is based on freedom of conscience—that is, his right to hold, and to affirm his personal moral values. Freedom of opinion has been attained only relatively recently in some countries of the world; in others, it still has to be asserted, and in all countries it has to be vigilantly defended because deprivation of this freedom is both an affront to human dignity and a severe form of mental cruelty. Respect for freedom of opinion has been incorporated in the United Nations' Universal Declaration of Human Rights.

"In recent years, there have been numerous public allegations concerning the current misuse of psychiatric diagnoses, psychiatric 'treatment' and enforced confinement in psychiatric institutions of persons whose only 'symptoms' have been the avowal of opinions disapproved by their society. These accusations have been directed in particular—though not exclusively—against the alleged incarceration of political dissenters in prison mental hospitals in the U.S.S.R.

"The World Federation for Mental Health resolutely opposes any such abuse of psychiatric procedures and calls on its Member Associations throughout the world promptly to investigate all such allegations, and to defend the individual's freedom of opinion where it appears to be threatened. The Federation also calls on the mental health professionals and the Governments of countries where there are no voluntary Mental Health Associations to investigate all charges of the misuse of psychiatric procedures for political ends, and to demonstrate convincingly to the world that such practices are not condoned in principle nor allowed to continue where they are shown to have occurred."

The Secretariat of the Federation has been moved to the Department of Psychiatry, University of the West Indies, Kingston 7, Jamaica, in a new wing of the University Teaching Hospital at Mona, Kingston, with Professor Michael Beaubrun as its President-Elect. Professor Beaubrun has been President of the Caribbean Psychiatric Association from 1968–71, and the first Professor of Psychiatry at the University of the West Indies since 1965. Other officers of WFMH are: Honorary Presidents—Professor Otto Klineberg, France and Lady Norman, U.K.; Vice-Presidents—Dr. Kurt Palsvig, Europe, Dr. T. Asuni, Africa, Professor E. Tchehrazi, Eastern Mediterranean, Dr. K. A. Meesook, Southeast Asia, Professor I. Pilowski, Western Pacific, and Dr. J. D. Griffin, Americas; Treasurer—Mr. Sam Steinwurzel. Miss Joyce Taylor from the Edinburgh Secretariat will provide continuity to the organization by moving to Jamaica.

News from the States

Connecticut

The Governor's Commission on Services and Expenditures recently issued a report that contained several recommendations concerning mental health programs. One recommendation involved reorganization of the Department of Mental Health into Direct Services, with Programs and Facilities sections, and Indirect Services, with sections on Administration, Program Planning, Development and Evaluation, Public Affairs, and Training and Staff Development. Other recommendations relevant to mental health included: improvements in the Ribicoff Research Center at Norwich Hospital, especially that presently vacant space be used by the University of Connecticut Department of Biobehavioral Science and the Connecticut Mental Health Center; development of a long-range mental health plan and an effective coordinated performance control system; redefinition of the regional mental health planning councils and their relationship to the department; establishment of a State-wide plan for treatment of alcohol and drug abusers; and determination of cost effectiveness of community mental health centers with the aid of simulation models. (From the *Connecticut Mental Health Reporter*)

Florida

A 5-year social psychiatric research project in Alachua County, Florida, is aimed toward the development of a model for evaluating mental health needs and services which takes into account the impact of culture change on mental health and illness. Alachua County now is in the throes of social changes similar to those in many parts of the Southeast—rural-urban shift, black-white confrontation, deprived-affluent imbalance, rapid population growth, and mobility. The evaluation model will be derived from a three-pronged research design comprising a study of who is receiving mental health care, a prevalence study, and a socioanthropologic analysis of the area.

The project, now beginning its 3rd year, has gathered data that will illustrate mental health needs and services and ascertain existing and emerging treatment patterns. A household survey of more than 2000 adults has yielded interview data on family and interpersonal networks, occupational patterns, physical and mental symptomatology, and attitudes toward and utilization of health care services. All data have not been analyzed; however, three major findings have emerged from an analysis of the present data: About one-third of the survey respondents were found to be impaired; the concurrence of physical and mental symptoms stresses the necessity for comprehensive health care; and there appear to be no differences in the treatment patterns (including amount of care received and source of care) between the not impaired and the impaired. This latter finding suggests that many of those who need more care are not receiving it. Further research will be directed toward those who need but are not receiving services, and a number of community agencies are planning to evaluate and modify their own service systems on the basis of research findings. (From a preliminary report by John J. Schwab, M.D. and George J. Warheit, Ph.D. in the *Journal of the Florida Medical Association, Inc.*, 59 (1):17–20, 1972.)

Kentucky

Rural community psychiatry has been evaluated in Scott County. Two psychiatrists and a social worker treated patients once weekly at the county health department building. Treatment dealt with acute symptoms and role dysfunction; patients were evaluated promptly. Consultation and educational services by school personnel, physicians, public health nurses, and court officials supplemented the treatment. Followup evaluations were made by personal interview, telephone or mailed questionnaire; 93 percent of the patients responded and were delighted to know someone cared how they were doing. The results suggest that rural programs can serve the full population of a catchment area and that open lines of communication with diverse community groups can be maintained. Of 118 patients, 80 reported their problems improved and 90 percent were satisfied with their treatment. Only nine patients dropped out because of dissatisfaction. The importance of liaison and referrals in a part-time program is stressed as is communication and understanding between community physicians and mental health center personnel. Use of, and familiarity with, the county health building was an advantage; a full-time secretary was on hand to make appointments and handle scheduling of the part-time service. (From an article by Charles L. Bowden, M.D. and Arvil E. Reeb, M.S.S.W. in the *Journal of the Kentucky Medical Association,* February 1972)

New York

The recently issued 1971 Annual Report of the New York State Health and Mental Hygiene Facilities Improvement Corporation indicates that hospitals for the physically and mentally ill, State schools for the retarded, and other health facilities now in design or construction by the Corporation are providing expanded and new accommodations for New York's citizens. The Corporation is authorized to design, construct or modernize, and equip health and health-related facilities for cities and counties and for private, nonprofit organizations. Mental health facilities are built for the State Department of Mental Hygiene and narcotic facilities for the State Narcotic Addiction Control Commission.

New accommodations for the mentally disabled are in projects underway in New York City and in Albany, Broome, Chemung, Monroe, Onondaga, Richmond, Saratoga, and Schenectady Counties.

Mental health projects in construction that contain inpatient facilities include four new psychiatric hospitals and six new State schools for the mentally retarded. Five children's psychiatric hospitals have beeen completed.

Pennsylvania

A special ad hoc Task Force on Commitment Provisions of the State Advisory Committee on Mental Health and Mental Retardation has recommended sweeping changes in the Mental Health and Mental Retardation Act of 1966. Two of the major proposals call for the creation of an independent government agency to maintain a constant review of all persons receiving mental care and the establishment of an Office of Public Guardian to provide

guardianship for persons mentally incapable of managing their own affairs. Another major change is to remove from the existing judicial system all hearing requirements. Hereafter these would be performed through the Review Service, and resort to the courts would occur only in an appellate setting except for retention of the right of habeas corpus. Other suggestions of the task force include: addition of an outreach program by the county mental health administrators; provision of care based on individual need, reflecting human services needs rather than "dangerousness;" provision that anyone 12 years of age or older may apply for care (a substantial lowering of the age of choice in these matters); provisions for compulsory care designed to provide the maximum of due process and to ensure that appropriate care is provided; and a complete rewriting of the requirements and procedures for dealing with persons involved with criminal law or laws regarding delinquency.

The first drug education and training center of the Commonwealth of Pennsylvania has been established as a joint project of the Department of Behavioral Science at Eastern Pennsylvania Psychiatric Institute and the Eagleville Hospital and Rehabilitation Center, a nonprofit, nonsectarian hospital for alcoholism and drug abuse patients. The center is designed to provide leadership in coping with the drug abuse problem across the State. It will develop a variety of training models for medical and mental health professionals and for personnel in treatment and prevention facilities.

The Foster Grandparent Program, operated by the State Department of Public Welfare, recently celebrated its 5th anniversary. At Selinsgrove State School and Hospital, 96 older persons have been employed as foster grandparents; 40 persons are currently participating in the program—eight men and 32 women ranging from 60 to 88 years of age. Pennsylvania's foster grandparents work in four State Welfare facilities for the mentally retarded, serving two children each, for 2 hours a day, 5 days a week. Their mission is to relate to the children in a supportive way with kindness, patience, and understanding. Not only do the children benefit from the program, but the foster grandparents themselves feel that their own lives have been enriched.
(From *The Challenge,* a publication of the Department of Welfare, Commonwealth of Pennsylvania)

Texas

Over 100 mental health workers from Arkansas, Louisiana, New Mexico, Oklahoma, and Texas attended the Rio Grande Valley Outreach Workshop in Brownsville, Tex., which focused on the delivery of mental health services in rural and remote areas. The Workshop was sponsored by the Hogg Foundation for Mental Health, the Texas Department of Mental Health and Mental Retardation, and the NIMH.

Participants discussed such problems as the establishment of the role and scope of the mental health worker, prevention and aftercare in mental illness, do's and don'ts in an outreach program, importance of good communication between workers in outreach programs and staff in hospitals and centers, how to recognize and strengthen weakness, and how to motivate a mentally ill patient. (From *Impact,* a publication of the Texas Department of Mental Health and Mental Retardation.)

recent nimh publications

Single copies of these publications may be obtained from the Office of Communications, National Institute of Mental Health (Publications Issuance Unit, Room 1B64, Parklawn Building, 5600 Fishers Lane, Rockville, Md. 20852). A complete list of all publications available from the NIMH may also be obtained from the Office of Communications. If a price is given, the publication may be ordered in quantity from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Enclose a check or money order payable to the Superintendent of Documents.

Crime and Delinquency Abstracts, Vol. 7, No. 6, Dec. 1971. This annotated bibliography contains 400 abstracts of articles on the nature of crime, antisocial behavior, cultural conflict, procedures, discussions and evolution of crime and its effects. Included also are an author and a subject index. DHEW Publication No. (HSM) 72–9075. 65¢.

Schizophrenia Bulletin No. 4, Fall 1971. This fourth experimental issue focuses on biochemistry and sleep studies of schizophrenia. A comprehensive review of the literature of the 1960's is presented and critiqued. Also contained is a collection of abstracts of the current literature on schizophrenia. DHEW Publication No. (HSM) 71–9046. $1.

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